614

ISE Na^+/K^+ Analyzer

Instruction Manual

CIBA·CORNING

The 614 is a sodium and potassium ISE analyzer. It is designed for fast and accurate determination of sodium and potassium in undiluted serum, plasma and whole blood, and pre-diluted urine samples. Minimum sample volume is 35 µL and the results are displayed on the alphanumeric readout in mmol/L (millimoles per litre).

The 604 is an autosampler designed for use with the 614 ISE analyzer. The sample tray will take up to 36 serum/plasma or urine samples (whole blood samples must not be measured on the autosampler), and autosampling can be interrupted at any time to allow the analysis of urgent samples. Minimum autosampler volume (serum/plasma) is 250 µL

The instruction manual contains complete instructions for setting-up and using the 614 and 604. The installation procedure is Section 1, followed by Power Up, Operating Instructions, Maintenance etc. A short time spent familiarizing yourself with these instructions will be more than repaid in the satisfactory operation of the 614 and 604.

Service information for the 614 and 604 for use by appropriately qualified personnel is also available.

WARNING: The 614 and 604 are designed to be grounded through the power supply lead (line cord) for safe operation. For the safety of operating personnel make sure that the instruments are only connected to 3-prong sockets (outlets) that have an effective earth connection. If you are in any doubt as to the safety of your electrical supply system consult a competent, qualified electrician.

There are no user replaceable parts within the instruments. Do not remove the covers from the 614 and 604.

Ciba Corning and their authorized Distributors and Agents consider themselves responsible for the effects on safety, reliability and performance of the 614 and 604 only if:

(i) assembly operations, extensions, re-adjustments, modifications or repairs are carried out by persons authorized by them,

(ii) the electrical installation of the relevant room complies with IEC requirements or the local regulatory code, and

(iii) the equipment is used in accordance with the instructions for use.

The information contained in this manual was correct at the time of going to print. However, Ciba Corning policy is one of continuous product improvement and the right to change prices, specifications, equipment and maintenance procedures at any time, without notice, is reserved.

The 614 Na^+/K^+ Analyzer and 604 Autosampler are classed as IEC Type B equipment (Class 1 equipment providing an adequate degree of protection against electric shocks particularly regarding allowable leakage currents and reliability of the protective earth connection).

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General Information

The M614 should be stored inside between 4°C and 45°C, maximum relative humidity 95% at 45°C. The commercial packaging does not allow this instrument to be stored directly exposed to the outdoor elements.

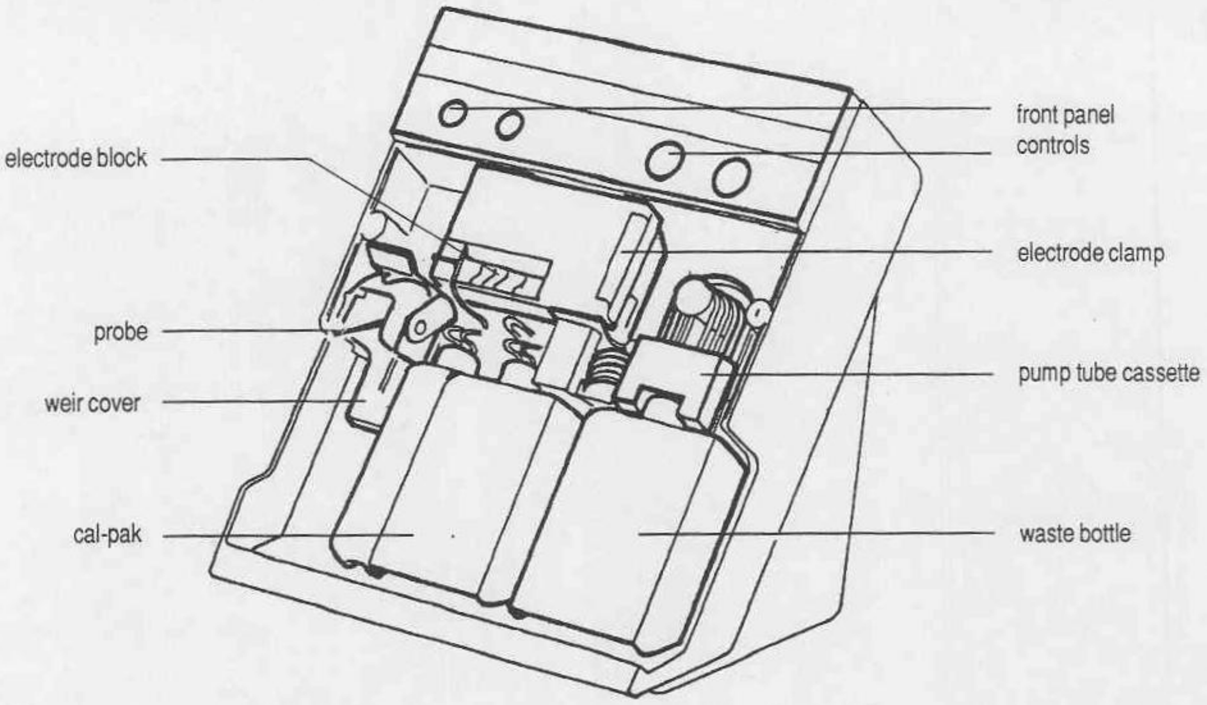
Storage Inspection/Maintenance

The packaging should be opened and the instrument checked every 24 months. After this check follow the instrument shutdown procedure detailed in Section 3.8.

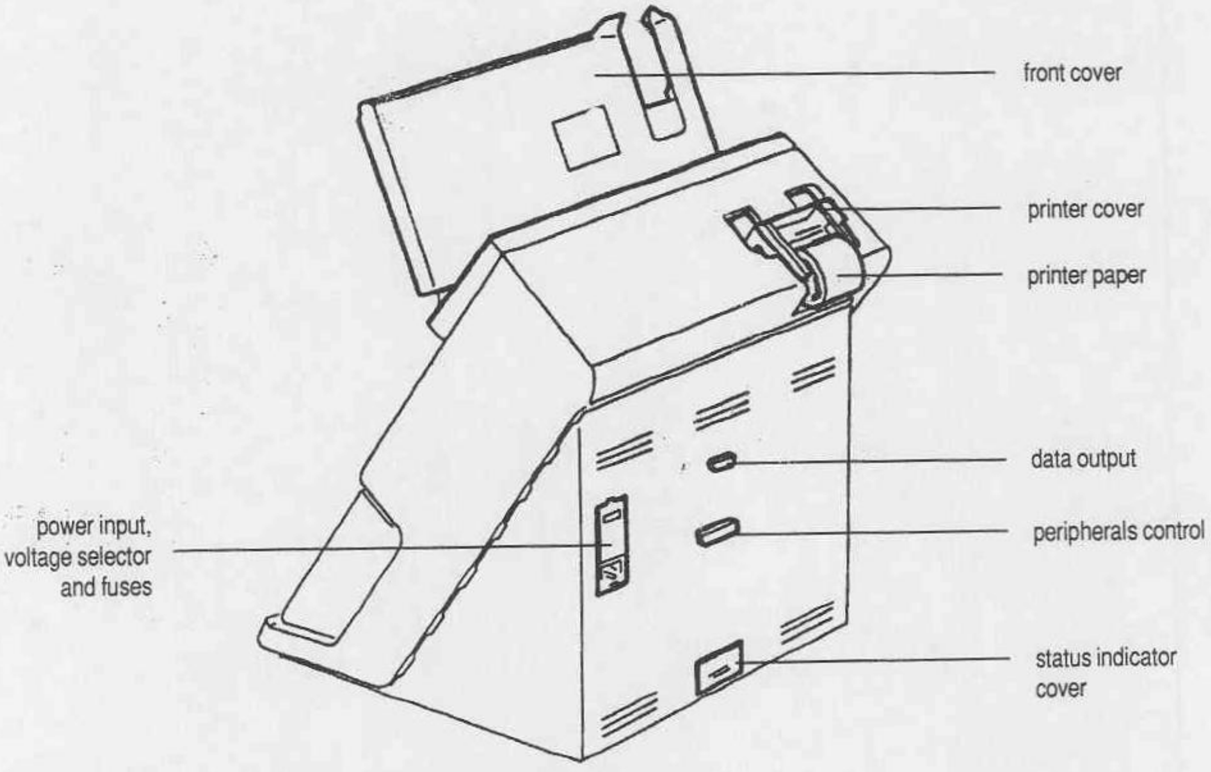
The Reagents and Calibrants Pack (2) and Electrodes Pack (3) should be checked and replaced if past the expiration date.

The instrument should be set up and run in accordance with the instruction manual.

Main Components of the 614

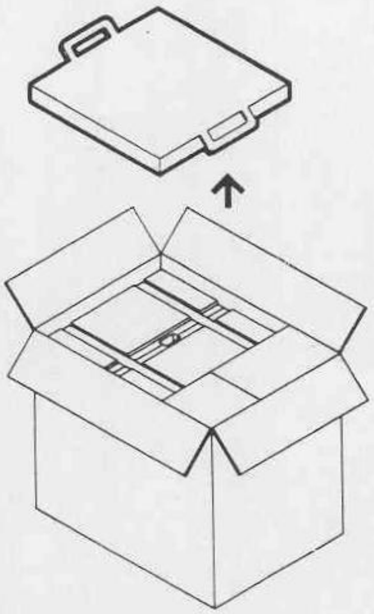

front panel controls
electrode block
electrode clamp
probe
pump tube cassette
weir cover
cal-pak
waste bottle

Front View (with front cover removed for clarity)

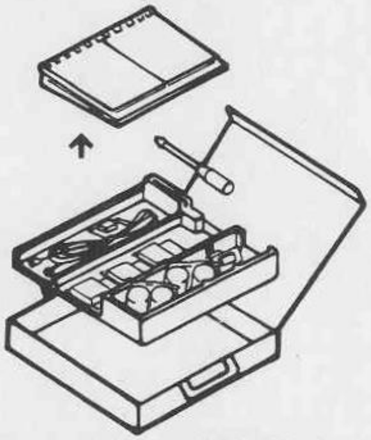

front cover
printer cover
printer paper
data output
power input, voltage selector and fuses
peripherals control
status indicator cover

Rear View

Unpacking the Accessories



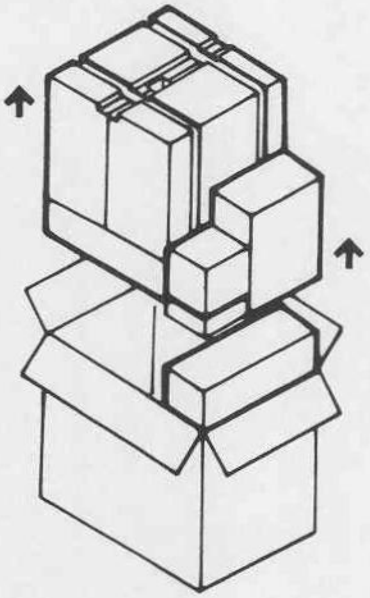
Remove the Installation Pack (1).



Remove the contents of the Installation Pack:

	Cat	Qty
Customer documentation pack	478627	1
Spare fuses	478648	2
Security key	478536	1
Clot removal line	478645	1
Spare probe and tubing kit	478634	1
Printer paper, 2 rolls	478638	2
Printer ribbon cassette	478637	2
$Na^+/K^+/Ca^{++}/Cl^-$ electrode fill solution	478535	1 pack
Troubleshooting guide	473539	1
Voltage selector bobbin, fuseholders and 2 fuses	———	1 kit
Screwdriver	———	1
Line cord	———	1

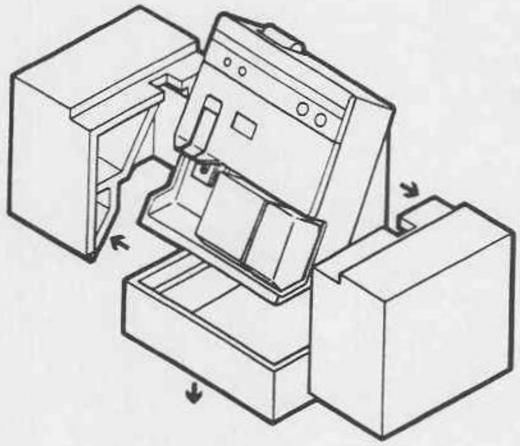
Unpacking the 614, Electrodes and Calibrants



Lift out the Calibrants and Reagents Pack 2 (Cat. 478541) and the Electrode Pack 3:

	Cat	Qty
Na^+ electrode	476266	1
K^+ electrode	476270	1
Reference electrode	476273	1

Lift out the Instrument Pack and cut the straps.

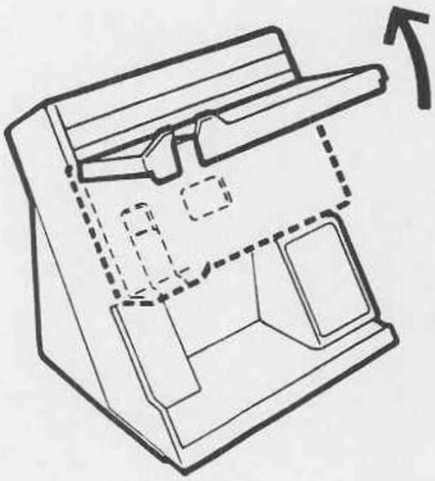


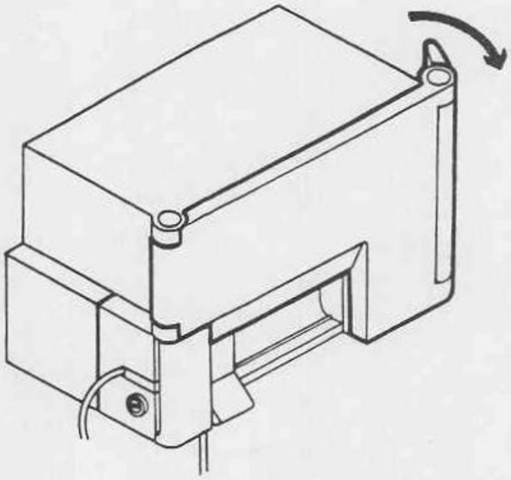
Remove all packaging. Check the instrument and all items for damage – if any items are missing or damaged contact Ciba Corning.

Position the 614 on a level bench, away from direct sunlight and drafts, 10°C to 35°C. The 614 needs approximately 450 x 450 mm (18 x 18 inches) bench space.

The Instruction Manual contains complete instructions for installing, using and maintaining the analyzer. Please refer to the manual before using the 614.

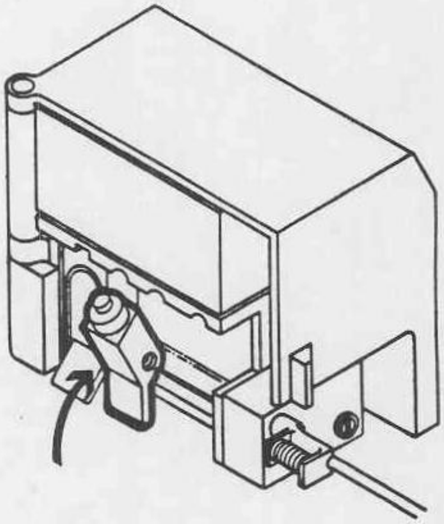
1.2 Installing the Na^+ and K^+ Electrodes



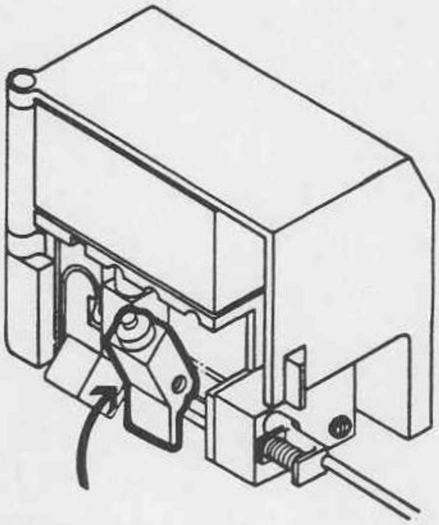


Raise the sample area cover.....................and release the electrode clamp.

Check the level of solution in the Na^+ and K^+ electrodes. If the solution is below the bottom of the screw thread, empty the electrode and refill using $Na^+/K^+/Ca^{++}$ electrode fill solution. Follow the instructions on the fill solution pack. Make sure there are no air bubbles trapped in the electrodes.



Insert K^+ electrode.

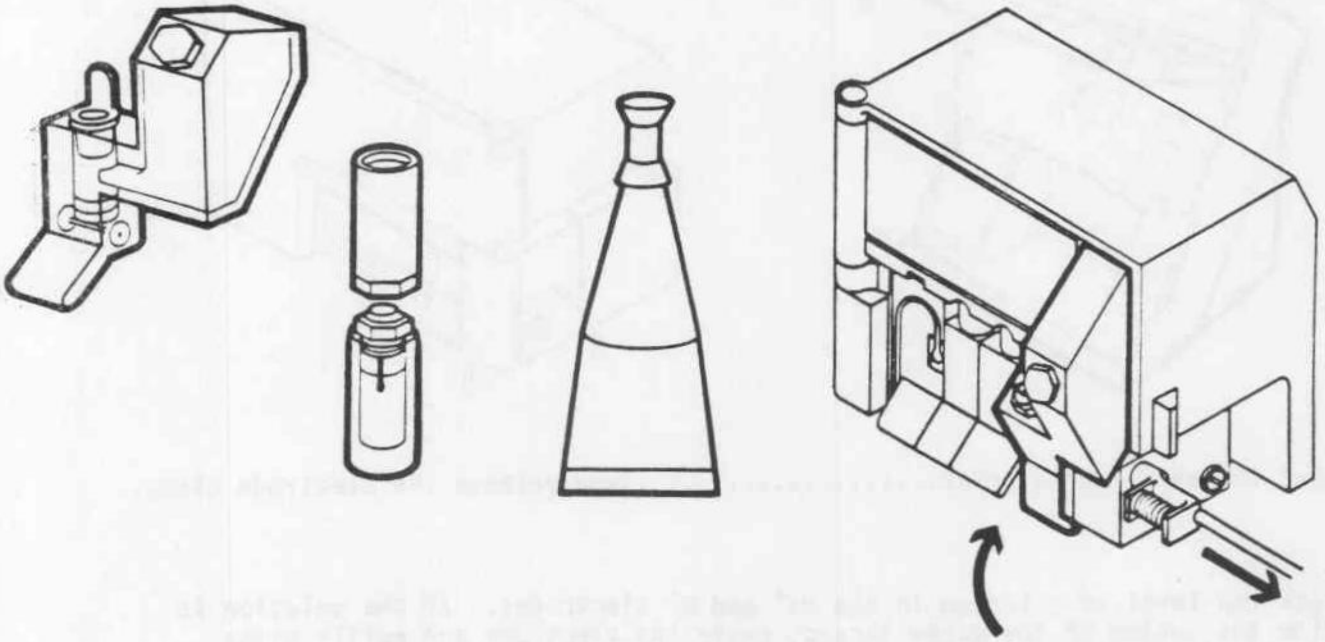


Insert Na^+ electrode.

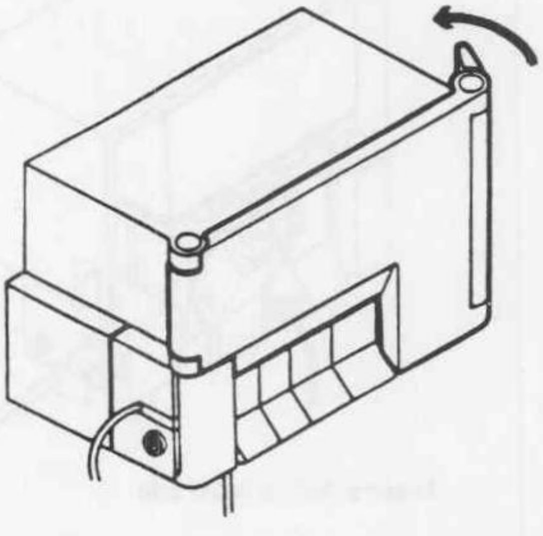
(The K^+ electrode may require a stabilization time of up to 90 minutes from installation before optimum performance is obtained).

1.3 Installing the Reference Electrode

Refer to the reference electrode product insert for filling instructions.

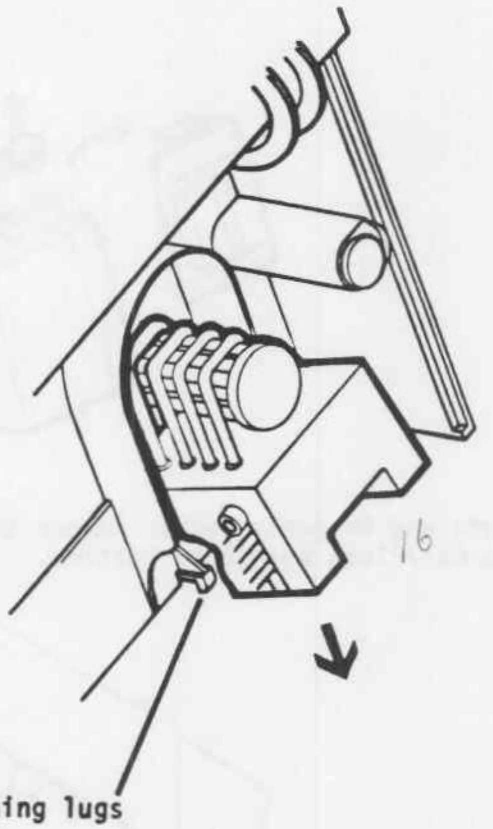


Withdraw the waste tube plunger and insert the reference electrode. Replace the plunger.



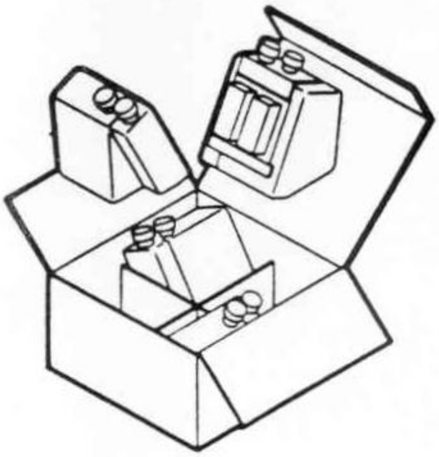
Fasten the electrode clamp.

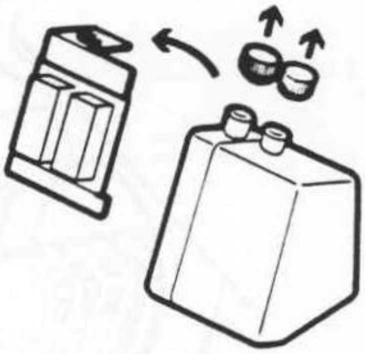
1.4 Tensioning the Pump Tube Cassette



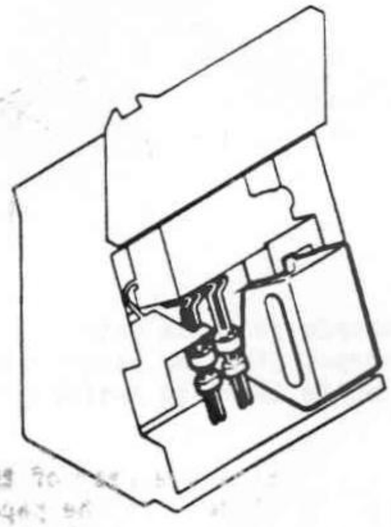
Remove the waste bottle. Pull the pump tube cassette downwards and ease onto the tensioning lugs. Date the label three months ahead. Reposition the waste bottle under the pump tube cassette, making sure that the waste tubes go inside the neck of the bottle.

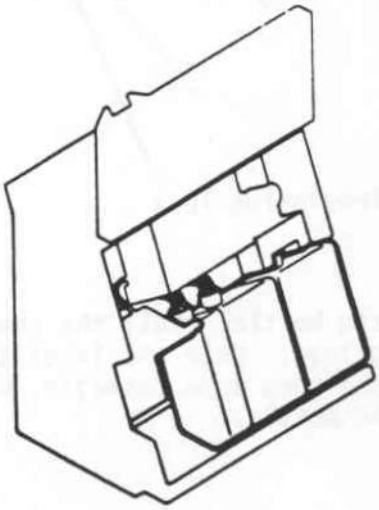
1.5 Installing Reagents



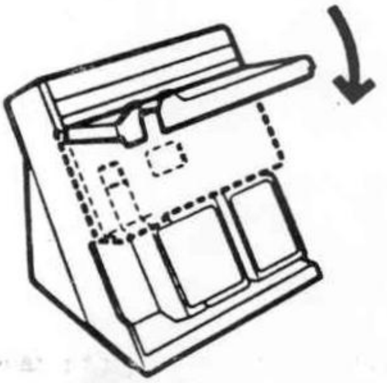


Take a Cal-Pak out of the Calibrants and Reagents Pack. Remove the Deproteinizer/ Conditioner Pack and caps from the Cal/Flush and Slope bottles.



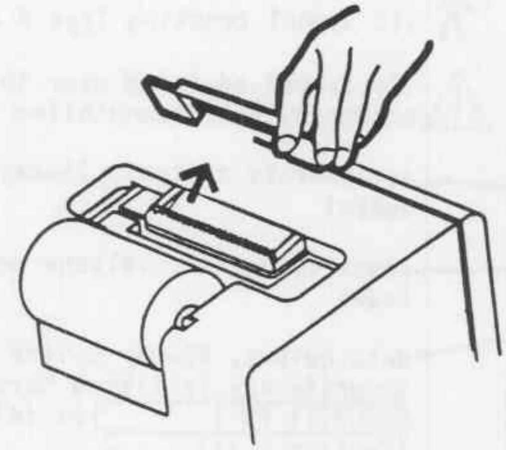


Insert the tubing connectors into the bottles. Place the bottle assembly in the lefthand side of the calibrant compartment and push the tubing connector caps onto the bottles. If necessary, feed the tubes through the connectors into the bottles.

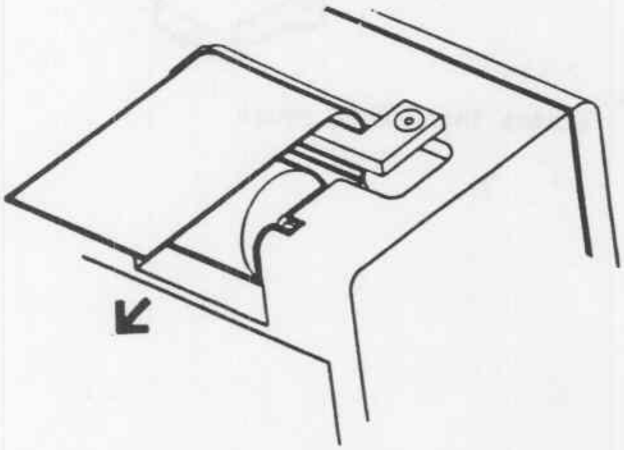


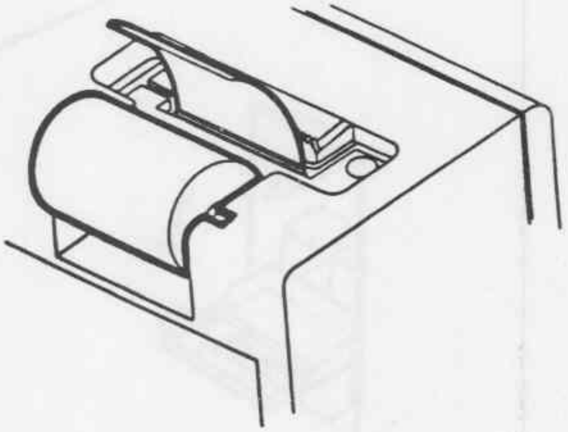
Lower the sample area cover.

1.6 Fitting the Printer Ribbon Cassette

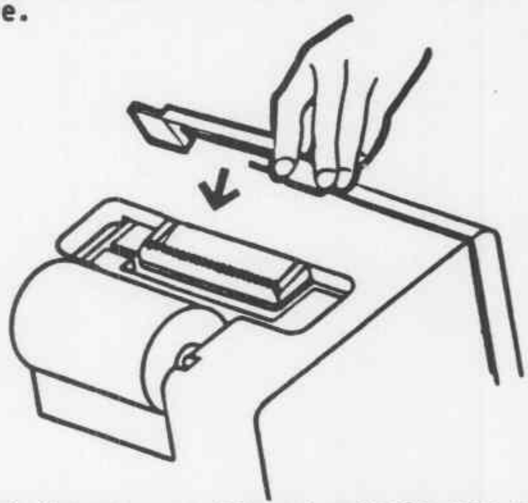


Lift out the printer cover.



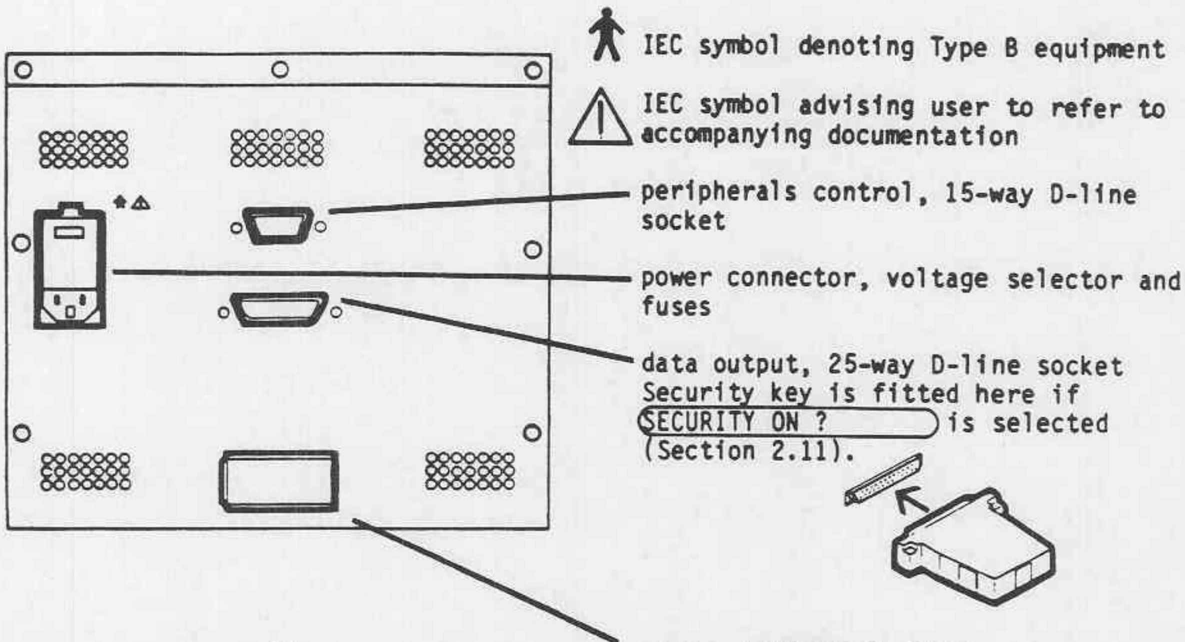


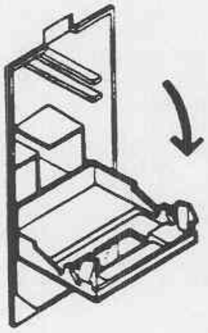
Fit a printer ribbon cassette - pull the printer paper tight towards the rear of the 614 and feed the paper between the ribbon and the cassette. Still holding the paper taut, slide the cassette towards the front of the 614, then press down to lock it into place.



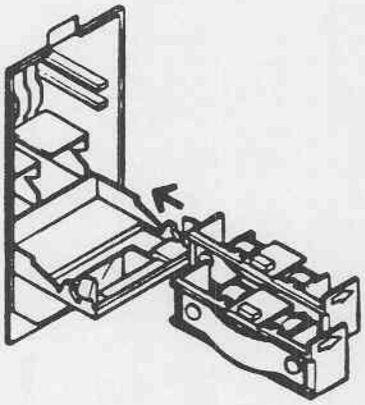
Check that the paper roll and spindle are correctly positioned, and remove the tape. Replace the printer cover.

1.7 The Rear Panel - Selecting Voltage


IEC symbol denoting Type B equipment
IEC symbol advising user to refer to accompanying documentation
peripherals control, 15-way D-line socket
power connector, voltage selector and fuses
data output, 25-way D-line socket Security key is fitted here if SECURITY ON ? is selected (Section 2.11).
status indicators cover

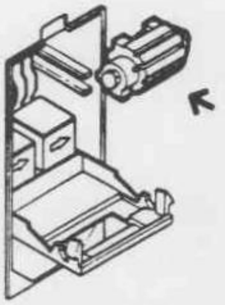


Open the voltage selector cover with the screwdriver supplied.



Insert the two fuses into the fuseholders and slide the fuseholders into the voltage selector.

1.7 The Rear Panel - Selecting Voltage (cont)

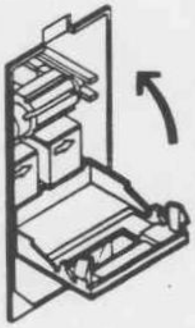


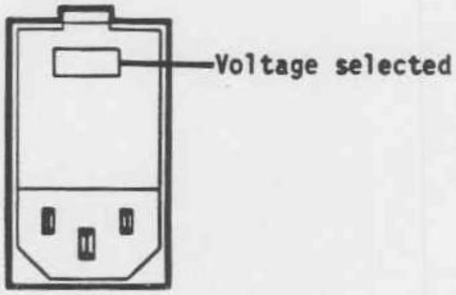
Select the voltage required for the local supply.

Voltage Selected	Voltage Range
100V	85V to 110V
120V	102V to 132V
220V	187V to 242V
240V	204V to 264V

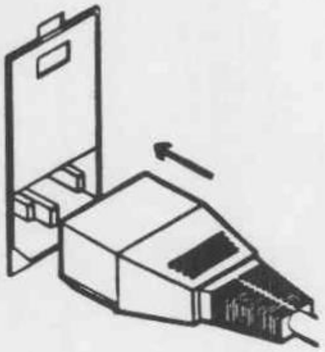
Slide the voltage selector bobbin into the voltage selector so that the selected voltage is visible when the voltage selector cover is closed.

CAUTION: Do not rotate the bobbin when it is fitted in the voltage selector as this will damage the contacts.





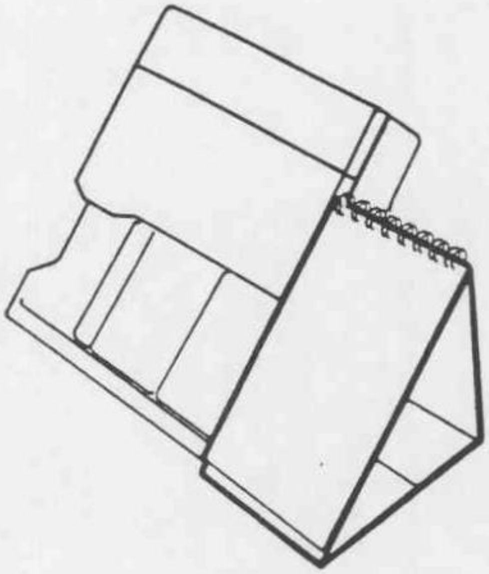
Close the voltage selector cover.



If necessary, connect a suitable plug to the line cord. Connect the line cord to the power connector on the rear panel.

NOTE: Do not connect the line cord to the power supply.

1.8 Positioning the Operator's Guide



Open the Operator's Guide and place it to the right of the 614.

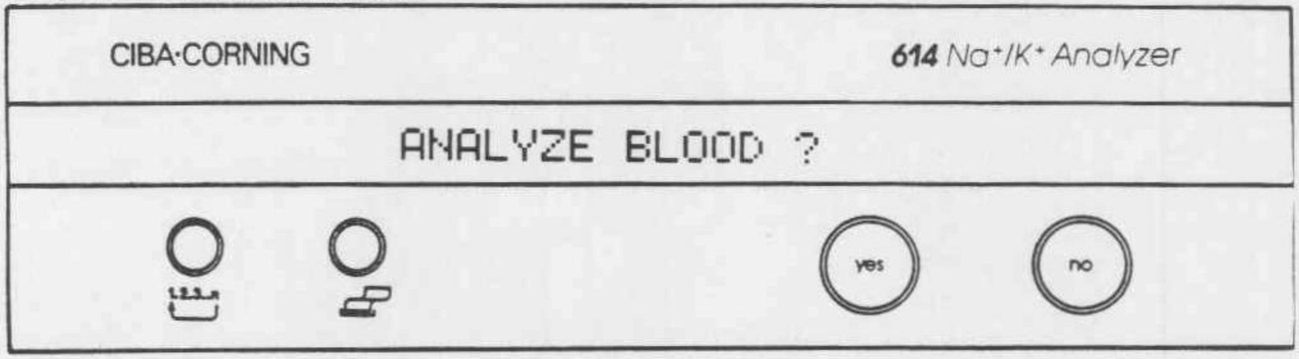
2.1 Power Up Routine

Check that the voltage selector is set correctly for the local a.c. supply. If it is not, set correctly, Section 5.20.

If powering up for the first time or if the a.c. supply has been disconnected for more than 30 minutes follow this procedure.

NOTE: If the a.c. supply has been disconnected for less than 30 minutes, the 614 will retain all previously selected data settings. The instrument will standardize and display (ANALYZE BLOOD ?) Refer to Section 3.2, or for other routines, Section 3.1, Menu Routing Maps.

Figure F2.1 Instrument Control Panel



sample number reset **paper advance** **controls used to respond to questions displayed by the 614**

Connect the line cord to a suitable power socket.

(HHHHHHHHHHHHHHHHHHHH) **Three lines of characters to allow the user to check the alphanumeric display.**
▼
(IIIIIIIIIIIIIIIIIIII)
▼
(####################)

2.2 Select Language

(LANGUAGE = ENGLISH ?) (no) ► **Alternative language**
(yes)
▼
(SET DATE/TIME ?)

NOTE: In the following routines, change the display value as follows

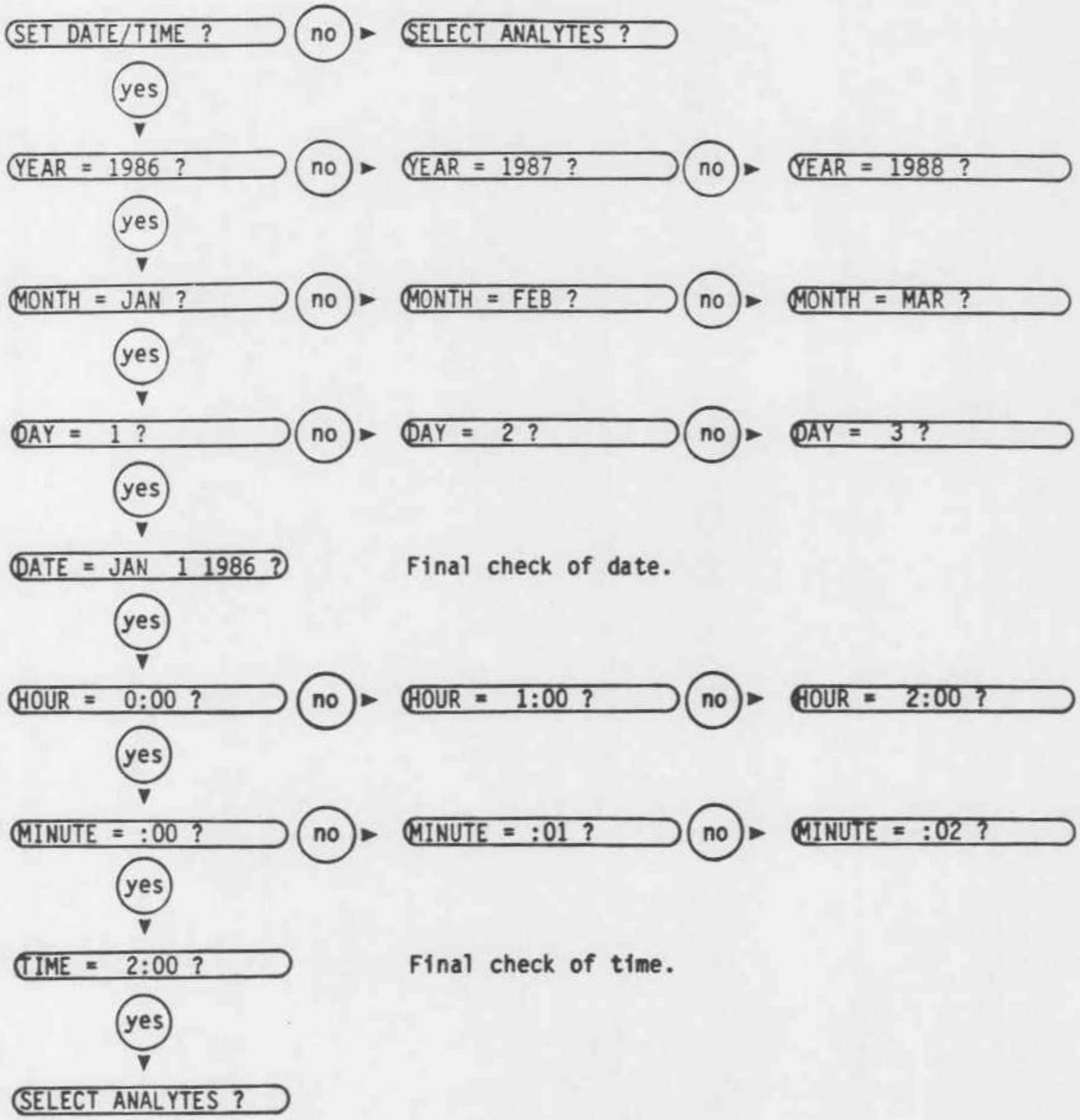
(no) **increases the display value;** 1.2.3..n + (no) **decreases the display value**

If the controls are pressed and held, the display will increase/decrease more rapidly.

2.3 Set Date/Time

Allows printouts to show the date and time of calibrations and measurements. Date and time must be set if QC Prompt routine is to be used, as this routine prompts QC checks at selected times.

For example:

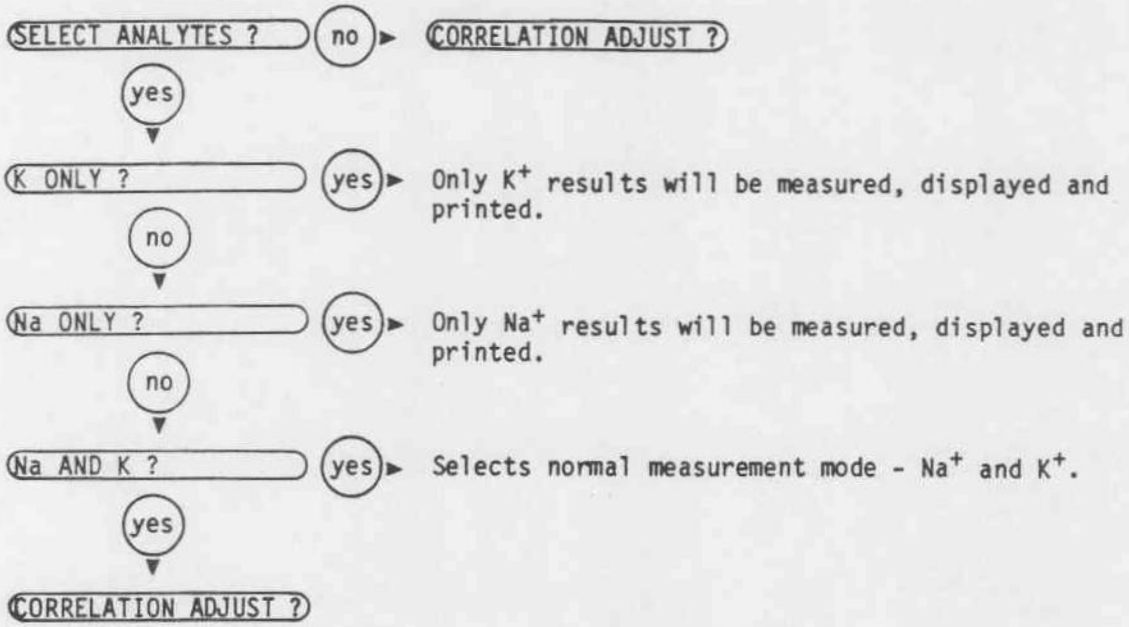

SET DATE/TIME ?
no
SELECT ANALYTES ?
yes
YEAR = 1986 ?
no
YEAR = 1987 ?
no
YEAR = 1988 ?
yes
MONTH = JAN ?
no
MONTH = FEB ?
no
MONTH = MAR ?
yes
DAY = 1 ?
no
DAY = 2 ?
no
DAY = 3 ?
yes
DATE = JAN 1 1986 ?
yes
HOUR = 0:00 ?
no
HOUR = 1:00 ?
no
HOUR = 2:00 ?
yes
MINUTE = :00 ?
no
MINUTE = :01 ?
no
MINUTE = :02 ?
yes
TIME = 2:00 ?
yes
SELECT ANALYTES ?

Final check of date.

Final check of time.

2.4 Select Analytes

Allows the choice of measurement channels: Na^+ only, K^+ only, or Na^+ and K^+.


SELECT ANALYTES ?
no
CORRELATION ADJUST ?
yes
K ONLY ?
yes
no
Na ONLY ?
yes
no
Na AND K ?
yes
yes
CORRELATION ADJUST ?

Only K^+ results will be measured, displayed and printed.

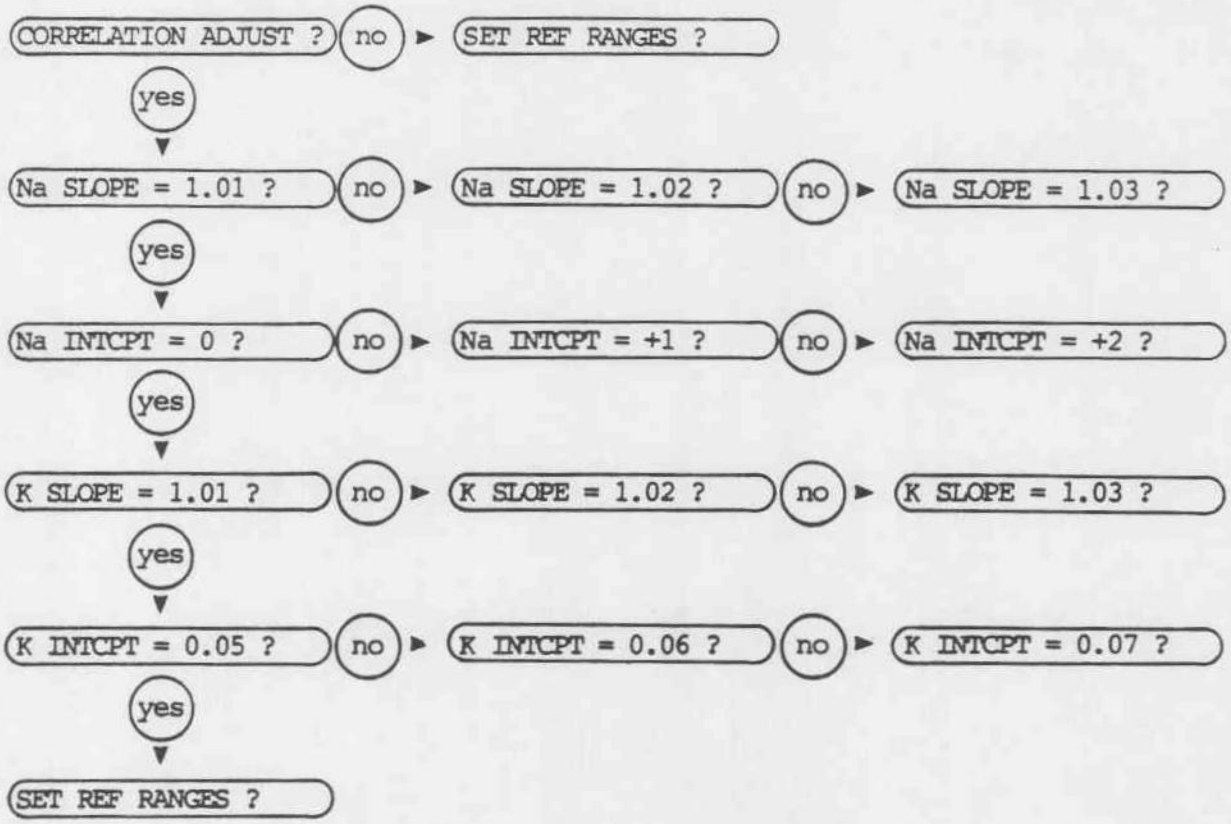
Only Na^+ results will be measured, displayed and printed.

Selects normal measurement mode - Na^+ and K^+.

2.5 Correlation Adjust

The 614 automatically gives results which correlate with results from Flame Photometers on a mean population basis, for samples with a normal pH range, containing normal levels of lipids and proteins. It is also possible to reset the correlation factors so that the 614 gives results which statistically correlate with results from other equipment.

WARNING: Before changing the correlation factors it is imperative that the correct procedure for determining alternative factors is followed to eliminate the possibility of erroneous results, please refer to Section 8.2. Unless this procedure is followed use the 614 factory set values for slope and intercept i.e. Na^+ slope = 1.01, Na^+ intercept = 0, K^+ slope = 1.01 and K^+ intercept = 0.05, as shown here.


CORRELATION ADJUST ?
no
SET REF RANGES ?
yes
Na SLOPE = 1.01 ?
no
Na SLOPE = 1.02 ?
no
Na SLOPE = 1.03 ?
yes
Na INTCPT = 0 ?
no
Na INTCPT = +1 ?
no
Na INTCPT = +2 ?
yes
K SLOPE = 1.01 ?
no
K SLOPE = 1.02 ?
no
K SLOPE = 1.03 ?
yes
K INTCPT = 0.05 ?
no
K INTCPT = 0.06 ?
no
K INTCPT = 0.07 ?
yes
SET REF RANGES ?

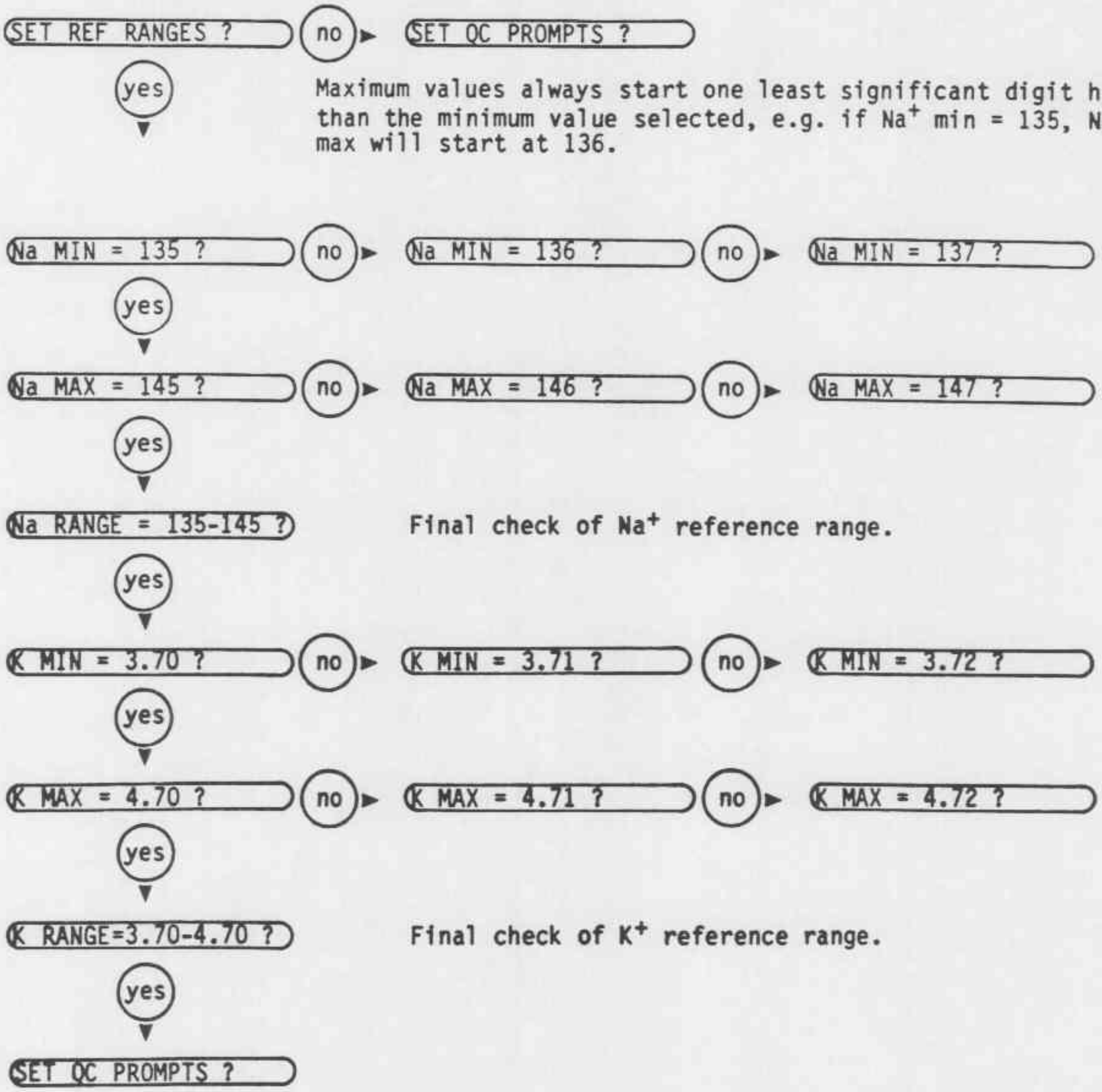
NOTE: Software versions prior to 1.6 had the following factory set values:-

Na^+ slope = 1.02, Na^+ intercept = 0, K^+ slope = 0.96 and K^+ intercept = 0.15

2.6 Set Ref Ranges

Allows user determined reference ranges for Na^+ and K^+ values to be entered.
Results outside these ranges will be flagged.
The ranges available are Na^+ 130 - 150, K^+ 2.50 - 6.00.

For example:


SET REF RANGES ?
no
SET QC PROMPTS ?
yes
Na MIN = 135 ?
no
Na MIN = 136 ?
no
Na MIN = 137 ?
yes
Na MAX = 145 ?
no
Na MAX = 146 ?
no
Na MAX = 147 ?
yes
Na RANGE = 135-145 ?
yes
K MIN = 3.70 ?
no
K MIN = 3.71 ?
no
K MIN = 3.72 ?
yes
K MAX = 4.70 ?
no
K MAX = 4.71 ?
no
K MAX = 4.72 ?
yes
K RANGE=3.70-4.70 ?
yes
SET QC PROMPTS ?

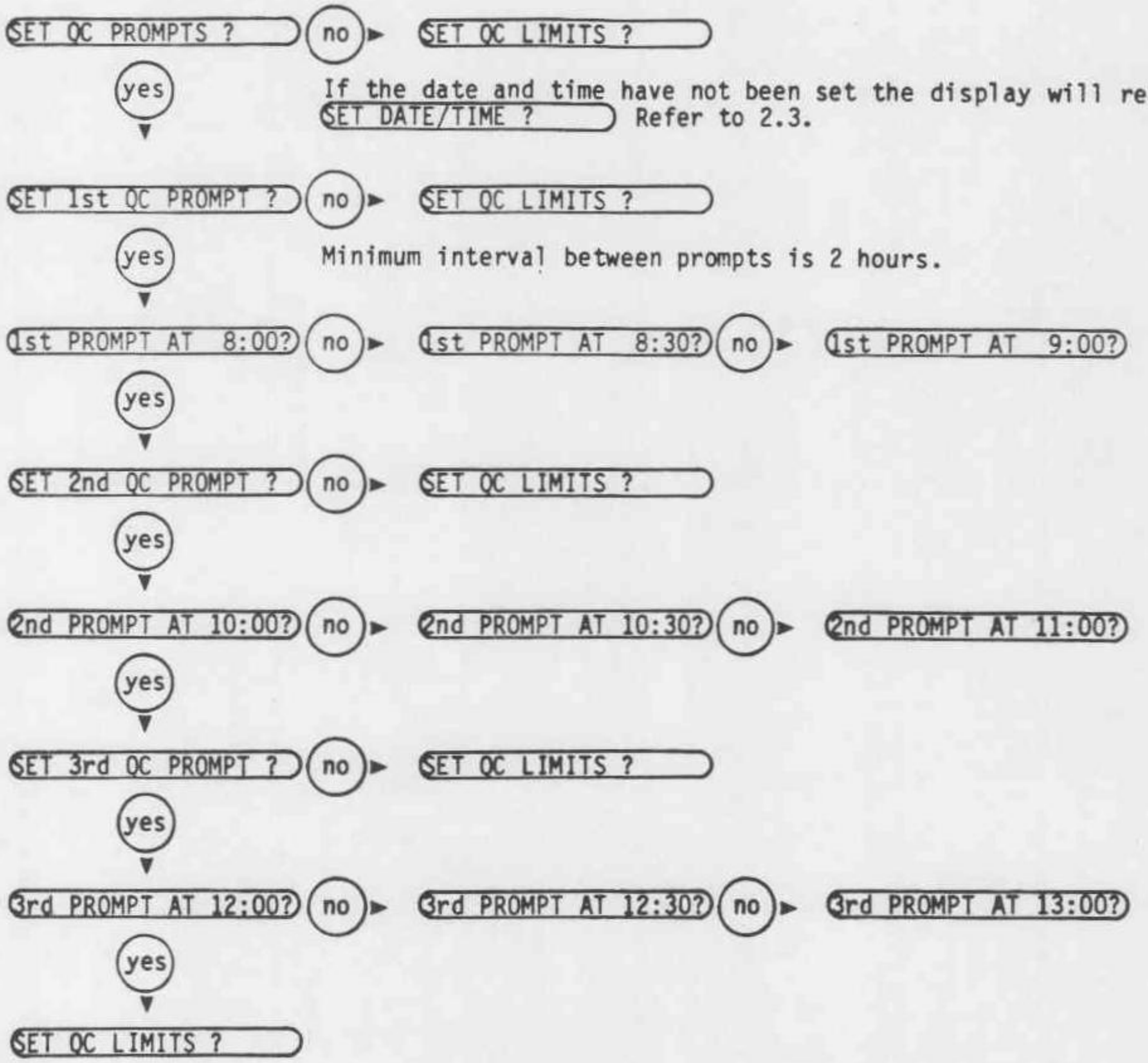
Maximum values always start one least significant digit higher than the minimum value selected, e.g. if Na^+ min = 135, Na^+ max will start at 136.

Final check of Na^+ reference range.

Final check of K^+ reference range.

2.7 Set QC Prompts

Allows QC prompt times to be set (up to 3 in 24 hours), to remind the user to measure a QC sample.


SET QC PROMPTS ?
no
SET QC LIMITS ?
yes
SET 1st QC PROMPT ?
no
SET QC LIMITS ?
yes
1st PROMPT AT 8:00?
no
1st PROMPT AT 8:30?
no
1st PROMPT AT 9:00?
yes
SET 2nd QC PROMPT ?
no
SET QC LIMITS ?
yes
2nd PROMPT AT 10:00?
no
2nd PROMPT AT 10:30?
no
2nd PROMPT AT 11:00?
yes
SET 3rd QC PROMPT ?
no
SET QC LIMITS ?
yes
3rd PROMPT AT 12:00?
no
3rd PROMPT AT 12:30?
no
3rd PROMPT AT 13:00?
yes
SET QC LIMITS ?

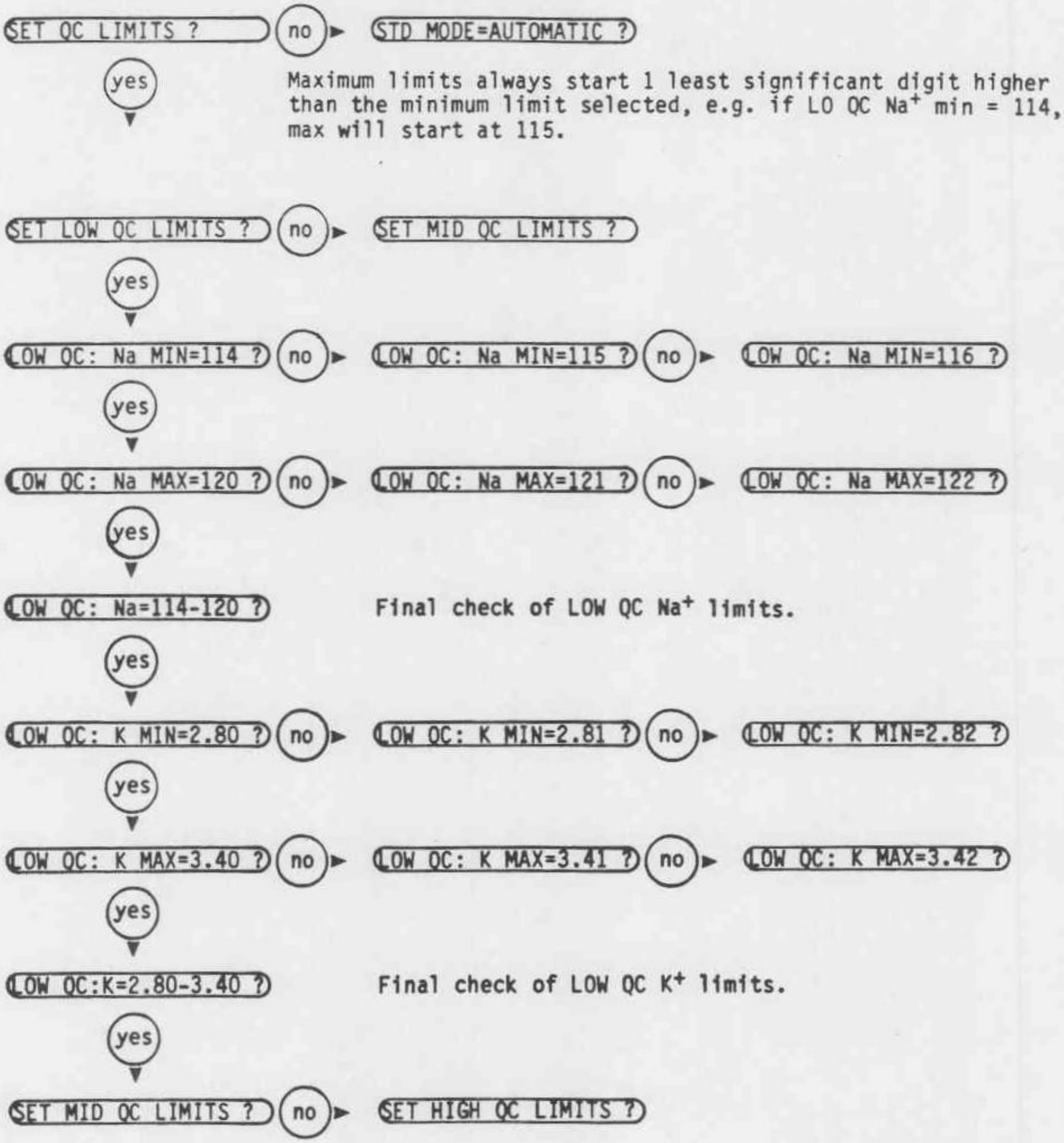
If the date and time have not been set the display will read SET DATE/TIME ? Refer to 2.3.

Minimum interval between prompts is 2 hours.

2.8 Set QC Limits

Allows acceptable ranges for QC results to be set. If QC results are outside these limits the 614 prompts a repeat measurement, and flags the results.
The limits available are Na^+ 105 - 199, K^+ 0.60 - 9.99

For example:

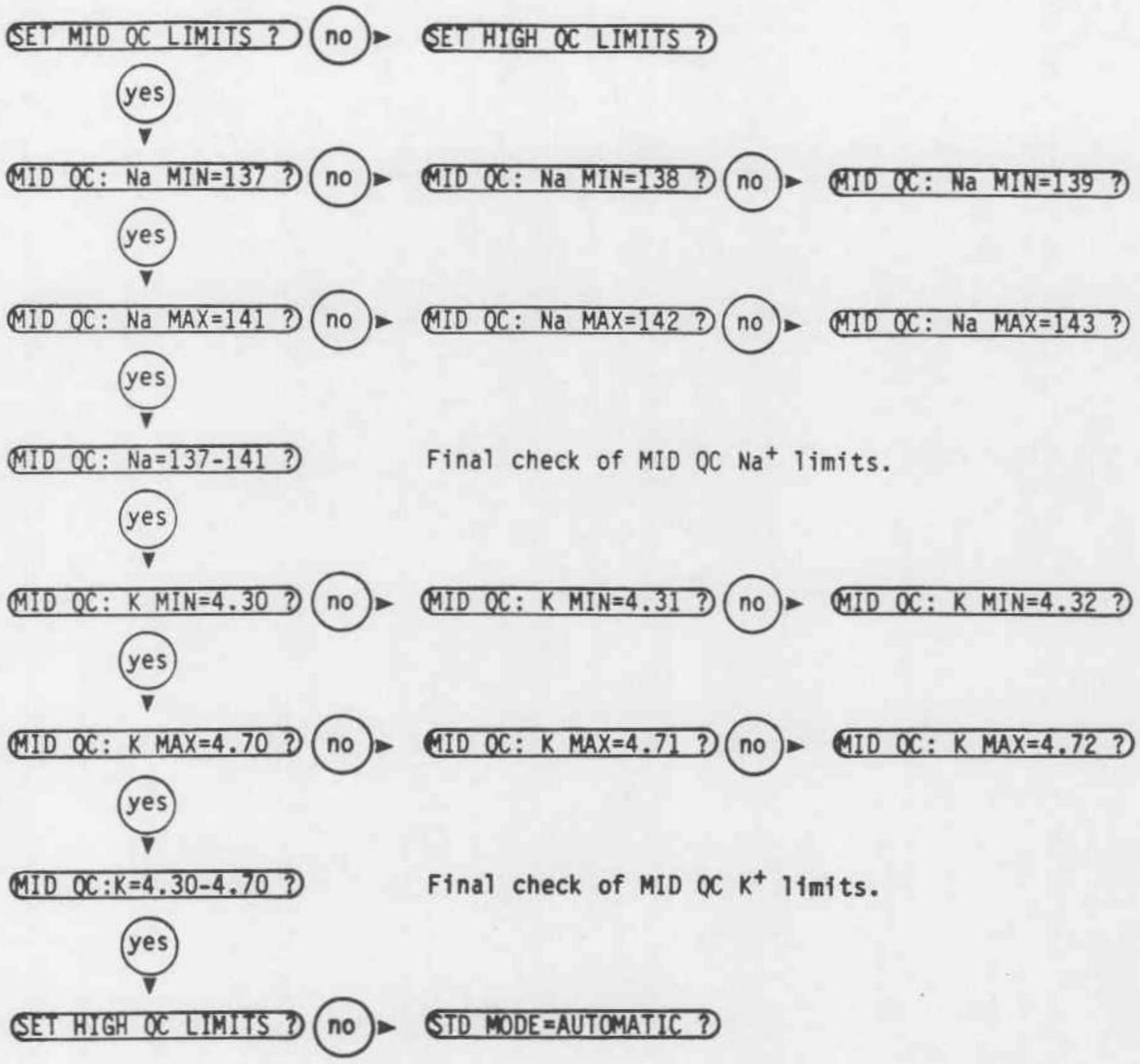

SET QC LIMITS ?
no
STD MODE=AUTOMATIC ?
yes
SET LOW QC LIMITS ?
no
SET MID QC LIMITS ?
yes
LOW QC: Na MIN=114 ?
no
LOW QC: Na MIN=115 ?
no
LOW QC: Na MIN=116 ?
yes
LOW QC: Na MAX=120 ?
no
LOW QC: Na MAX=121 ?
no
LOW QC: Na MAX=122 ?
yes
LOW QC: Na=114-120 ?
yes
LOW QC: K MIN=2.80 ?
no
LOW QC: K MIN=2.81 ?
no
LOW QC: K MIN=2.82 ?
yes
LOW QC: K MAX=3.40 ?
no
LOW QC: K MAX=3.41 ?
no
LOW QC: K MAX=3.42 ?
yes
LOW QC:K=2.80-3.40 ?
yes
SET MID QC LIMITS ?
no
SET HIGH QC LIMITS ?

Maximum limits always start 1 least significant digit higher than the minimum limit selected, e.g. if LO QC Na^+ min = 114, max will start at 115.

Final check of LOW QC Na^+ limits.

Final check of LOW QC K^+ limits.

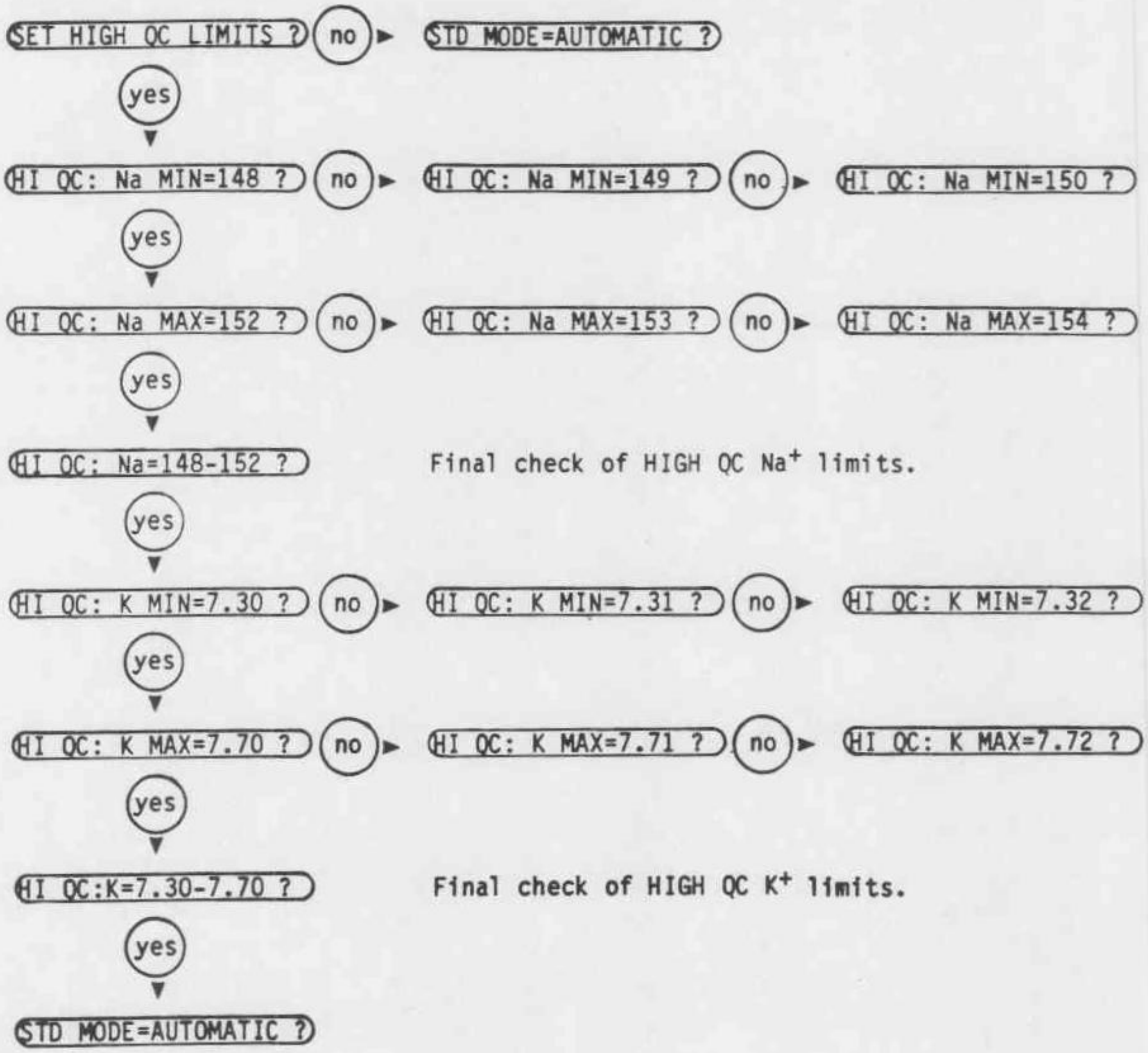
2.8 Set QC Limits (cont)


SET MID QC LIMITS ?
no
SET HIGH QC LIMITS ?
yes
MID QC: Na MIN=137 ?
no
MID QC: Na MIN=138 ?
no
MID QC: Na MIN=139 ?
yes
MID QC: Na MAX=141 ?
no
MID QC: Na MAX=142 ?
no
MID QC: Na MAX=143 ?
yes
MID QC: Na=137-141 ?
yes
MID QC: K MIN=4.30 ?
no
MID QC: K MIN=4.31 ?
no
MID QC: K MIN=4.32 ?
yes
MID QC: K MAX=4.70 ?
no
MID QC: K MAX=4.71 ?
no
MID QC: K MAX=4.72 ?
yes
MID QC:K=4.30-4.70 ?
yes
SET HIGH QC LIMITS ?
no
STD MODE=AUTOMATIC ?

Final check of MID QC Na^+ limits.

Final check of MID QC K^+ limits.

2.8 Set QC Limits (cont)

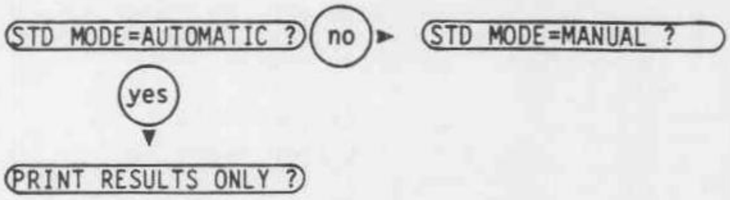

SET HIGH QC LIMITS ?
no
STD MODE=AUTOMATIC ?
yes
HI QC: Na MIN=148 ?
no
HI QC: Na MIN=149 ?
no
HI QC: Na MIN=150 ?
yes
HI QC: Na MAX=152 ?
no
HI QC: Na MAX=153 ?
no
HI QC: Na MAX=154 ?
yes
HI QC: Na=148-152 ?
yes
HI QC: K MIN=7.30 ?
no
HI QC: K MIN=7.31 ?
no
HI QC: K MIN=7.32 ?
yes
HI QC: K MAX=7.70 ?
no
HI QC: K MAX=7.71 ?
no
HI QC: K MAX=7.72 ?
yes
HI QC:K=7.30-7.70 ?
yes
STD MODE=AUTOMATIC ?

Final check of HIGH QC Na^+ limits.

Final check of HIGH QC K^+ limits.

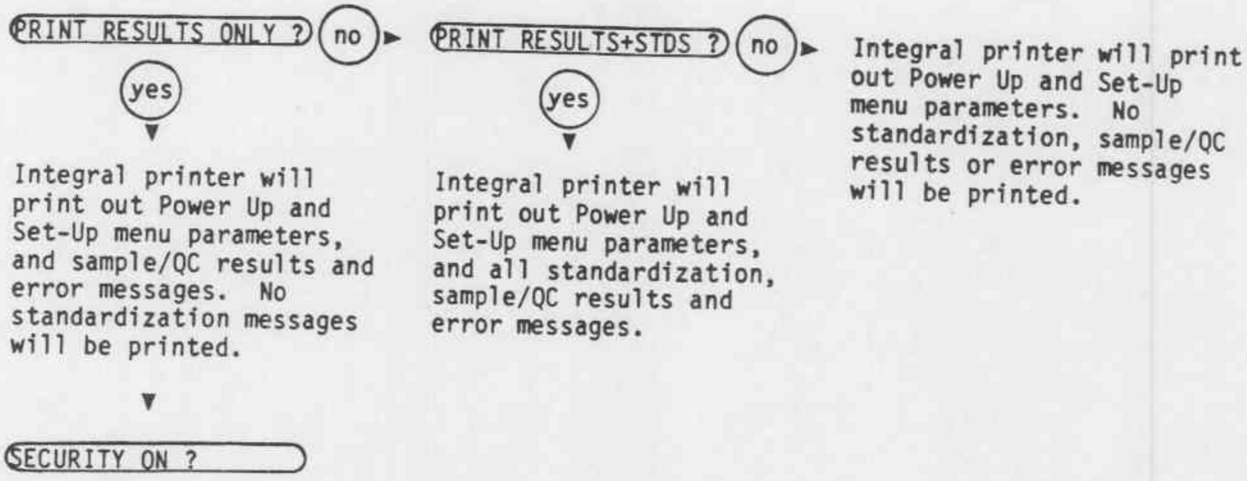
2.9 Standardization Mode

Selects the calibration mode. The 614 continually monitors drift - in automatic mode the time between calibrations is calculated to optimize stability and will be between 10 and 60 minutes; slope measurements are carried out every fourth calibration. In manual mode the 614 checks if calibration is required before allowing measurements. In both modes the electrodes are wetted and the pump tubes 'exercised' every 10 minutes.


STD MODE=AUTOMATIC ?
no
STD MODE=MANUAL ?
yes
PRINT RESULTS ONLY ?

2.10 Print Option

The integral printer can be set to print results only, results and standardizations, or Set-Up menu data only.


PRINT RESULTS ONLY ?
no
PRINT RESULTS+STDS ?
no
yes
yes
SECURITY ON ?

Integral printer will print out Power Up and Set-Up menu parameters, and sample/QC results and error messages. No standardization messages will be printed.

Integral printer will print out Power Up and Set-Up menu parameters, and all standardization, sample/QC results and error messages.

Integral printer will print out Power Up and Set-Up menu parameters. No standardization, sample/QC results or error messages will be printed.

2.11 Security Option

The 614 can prevent access to certain routines in the Set-Up menu. This safeguards against unauthorized or accidental changing of values.

`SECURITY ON ?` (no) ▶ All routines in the Set-Up menu can be accessed without using the security key.

(yes)

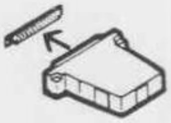
▼

The security key must be fitted to access the following routines in the Set-Up menu:

`CHANGE QC LIMITS ?`, `CHANGE QC PROMPT ?`, `CHANGE REF RANGES ?`,
`CHANGE SLOPE/INTCPT?`, `CHANGE DMS OPTION ?`, `CHANGE LANGUAGE ?`, `CHANGE SECURITY ?`

▼

`PRINTING SET-UP`



2.12 Conditioning Routine

PRIME AGAIN ? (yes) ► Prime routine

(no)

▼

CONDITION ? (no) ► CALIBRATING
PLEASE WAIT

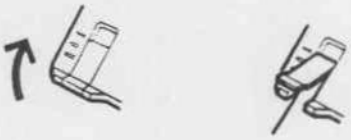
Ciba Corning recommend
that an electrode
conditioning routine is
carried out.

(yes)

▼

OPEN PROBE

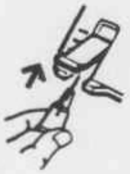
▼



PROBE IN SOLN C ?

(yes)

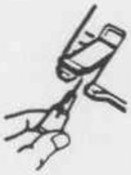
▼



NOTE: SOLN C = Conditioner.

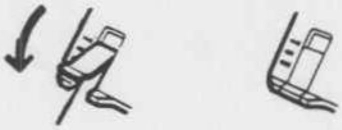
SAMPLING
SAMPLING - WAIT

▼



RETURN PROBE

▼



CONDITIONING
WAIT 5:00 MINUTES (counts down to zero)

▼

FLUSHING

▼

CALIBRATING
PLEASE WAIT

▼

2.12 Conditioning Routine (cont)

▼

▼

Na=140 K=4.00 mmol/L
CALIBRATION OK

▼

If the calibration is out of range, unstable or has drifted, or if the cal/flush solution is not detected, the 614 will automatically recalibrate. If three calibrations are unsuccessful the 614 will display

CAL FAILED - REPEAT? — no ► LAST RESULT RECALL ?

yes ▼ repeats calibration

Refer to Section 6, Troubleshooting. When fault has been corrected

▼

STANDARDIZE ?

yes ▼

The 614 will not allow sample or QC measurements until it has standardized successfully.

▼

▼

MEASURING SLOPE
PLEASE WAIT

▼

Na=110 K=8.00 mmol/L
SLOPE OK

▼

If the slope measurement is out of range, or unstable, or if the slope solution is not detected, the 614 will automatically recalibrate. If three slope measurements are unsuccessful the 614 will display

SLOPE FAILED-REPEAT? — no ► LAST RESULT RECALL ?

yes ▼ repeats calibration and slope measurement

Refer to Section 6, Troubleshooting. When fault has been corrected

▼

STANDARDIZE ?

yes ▼

The 614 will not allow sample or QC measurements until it has standardized successfully.

▼

▼

ANALYZE BLOOD ?

CAUTION: The 614 is designed to be connected to an a.c. supply at all times. If it is to be switched off the shutdown procedure must be carried out, Section 3.8. This will prevent damage to the instrument.

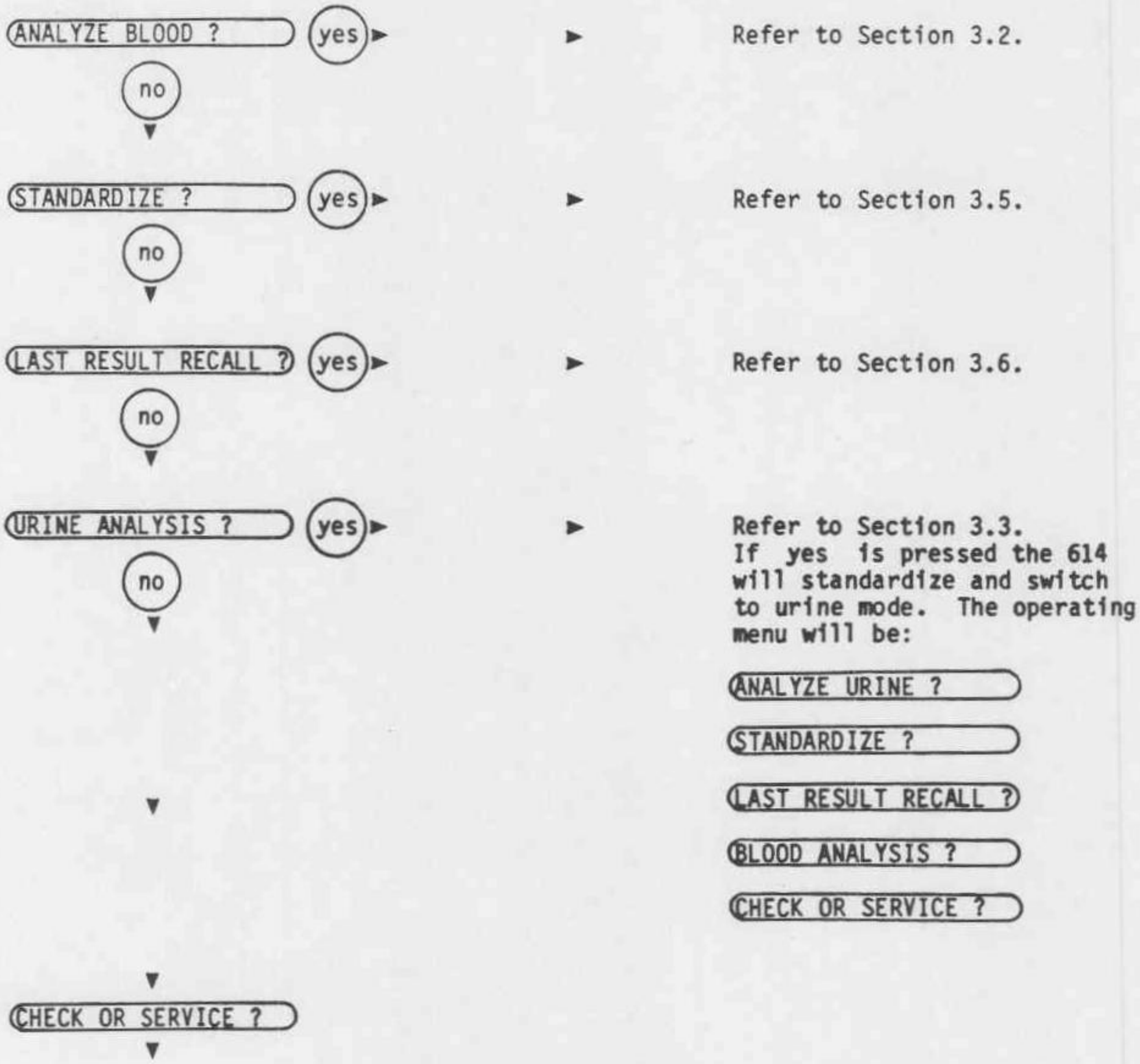
3.1 Menu Routing Maps – Operating Menu

The 614 has three menus; Operating menu - routines for sample measurement and standardization,

Check/Service menu - routines for QC measurement and for maintenance,

Set-Up menu - routines for setting parameters such as QC limits and reference ranges.

The menu routing map will help users access the routines in the three menus.


ANALYZE BLOOD ?
yes
no
STANDARDIZE ?
yes
no
LAST RESULT RECALL ?
yes
no
URINE ANALYSIS ?
yes
no
ANALYZE URINE ?
STANDARDIZE ?
LAST RESULT RECALL ?
BLOOD ANALYSIS ?
CHECK OR SERVICE ?
CHECK OR SERVICE ?

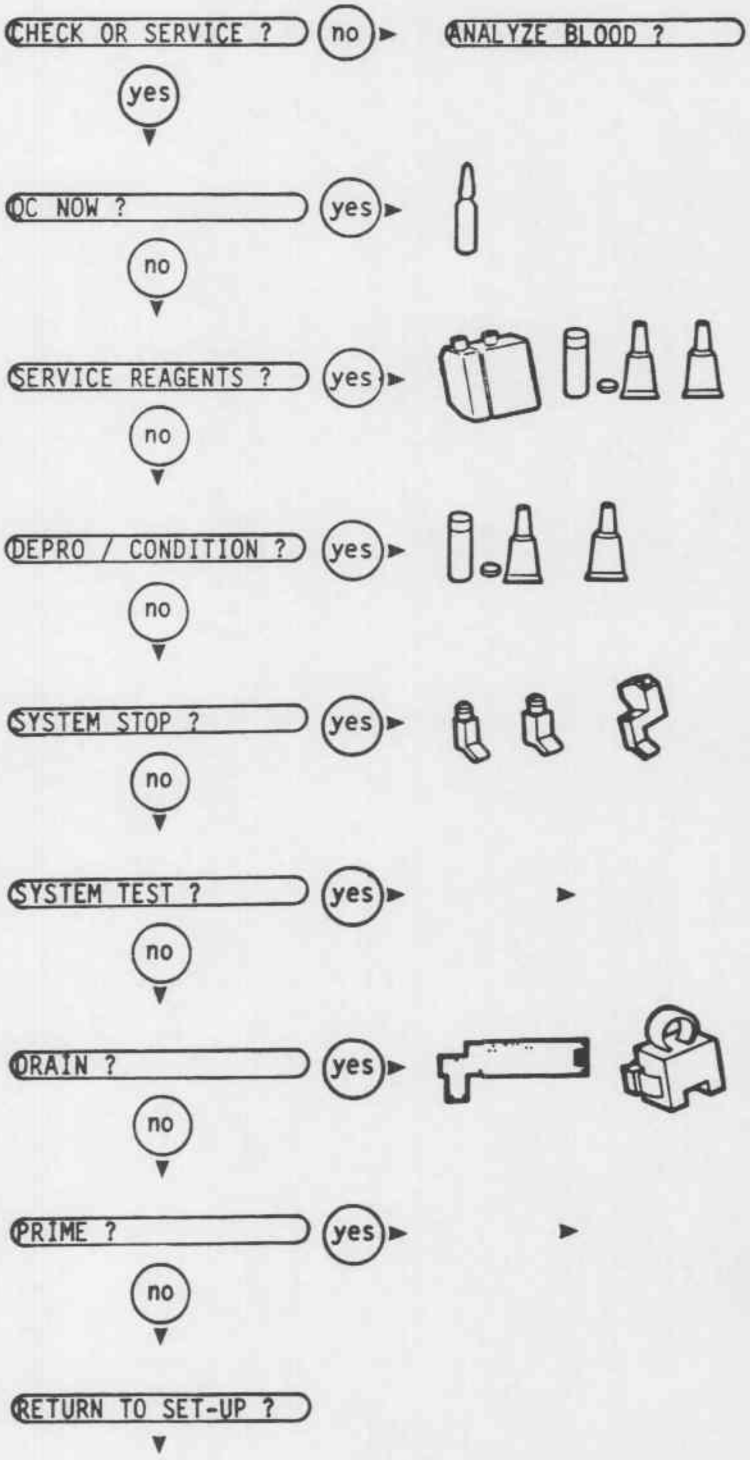
Refer to Section 3.2.

Refer to Section 3.5.

Refer to Section 3.6.

Refer to Section 3.3. If yes is pressed the 614 will standardize and switch to urine mode. The operating menu will be:

3.1 Menu Routing Maps – Check/Service Menu


CHECK OR SERVICE ?
no
ANALYZE BLOOD ?
yes
QC NOW ?
yes
no
SERVICE REAGENTS ?
yes
no
DEPRO / CONDITION ?
yes
no
SYSTEM STOP ?
yes
no
SYSTEM TEST ?
yes
no
DRAIN ?
yes
no
PRIME ?
yes
no
RETURN TO SET-UP ?

Refer to Section 3.7.
This message will only appear if QC Limits have been set (Section 2.8).

Refer to Section 5.4.

Refer to Section 5.4.

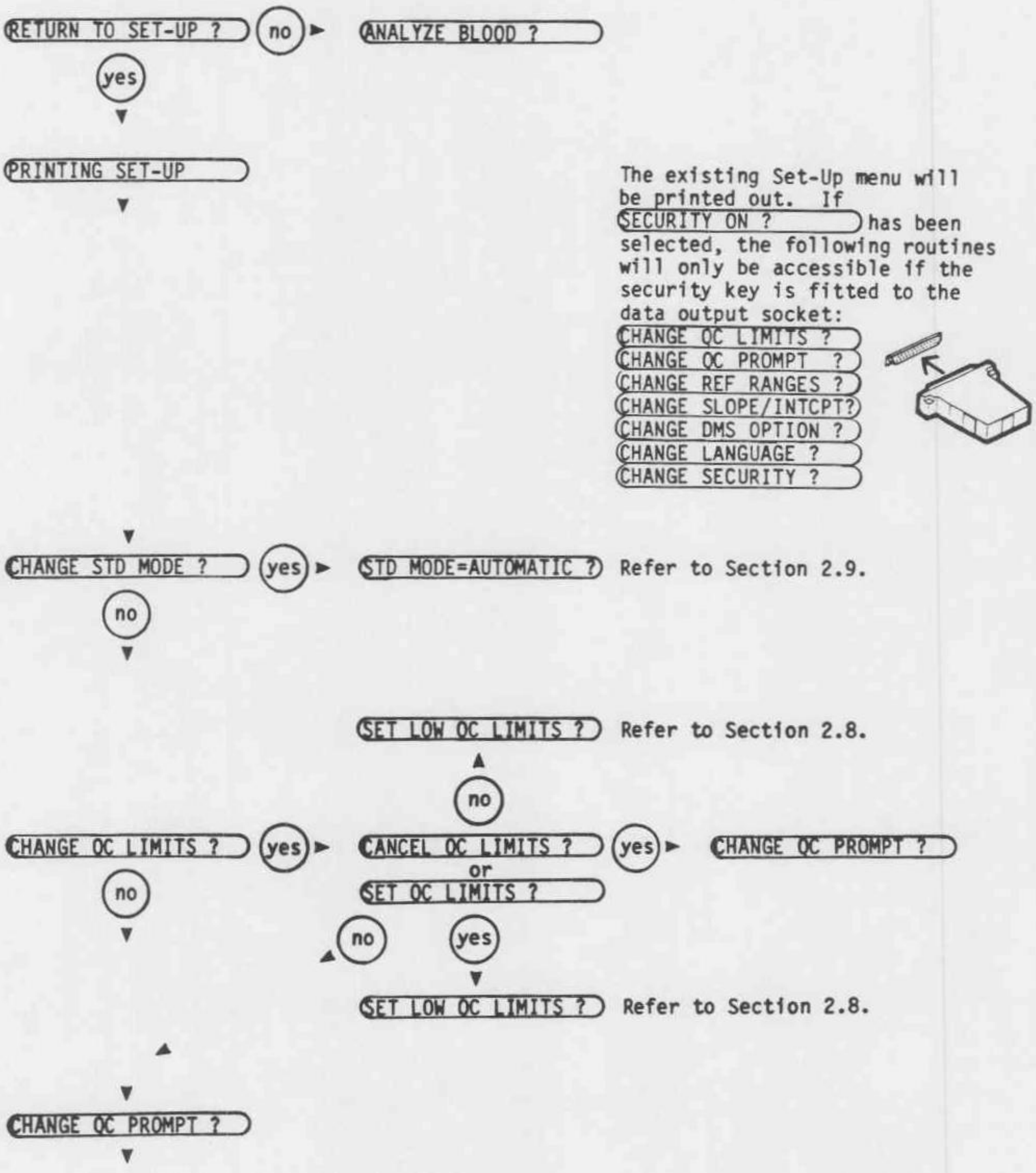
Suspends instrument functions and is used during routine maintenance and non-scheduled servicing.

Refer to Section 5.21.

Drains the hydraulic system and is used during routine maintenance and non-scheduled servicing.

Primes the hydraulic system and is used during routine maintenance and non-scheduled servicing.

3.1 Menu Routing Maps – Set-Up Menu


RETURN TO SET-UP ?
no
ANALYZE BLOOD ?
yes
PRINTING SET-UP
SECURITY ON ?
CHANGE QC LIMITS ?
CHANGE QC PROMPT ?
CHANGE REF RANGES ?
CHANGE SLOPE/INTCPT?
CHANGE DMS OPTION ?
CHANGE LANGUAGE ?
CHANGE SECURITY ?
CHANGE STD MODE ?
yes
STD MODE=AUTOMATIC ?
no
SET LOW QC LIMITS ?
no
CHANGE QC LIMITS ?
yes
CANCEL QC LIMITS ?
or
SET QC LIMITS ?
yes
CHANGE QC PROMPT ?
no
no
yes
SET LOW QC LIMITS ?
CHANGE QC PROMPT ?

The existing Set-Up menu will be printed out. If SECURITY ON ? has been selected, the following routines will only be accessible if the security key is fitted to the data output socket:

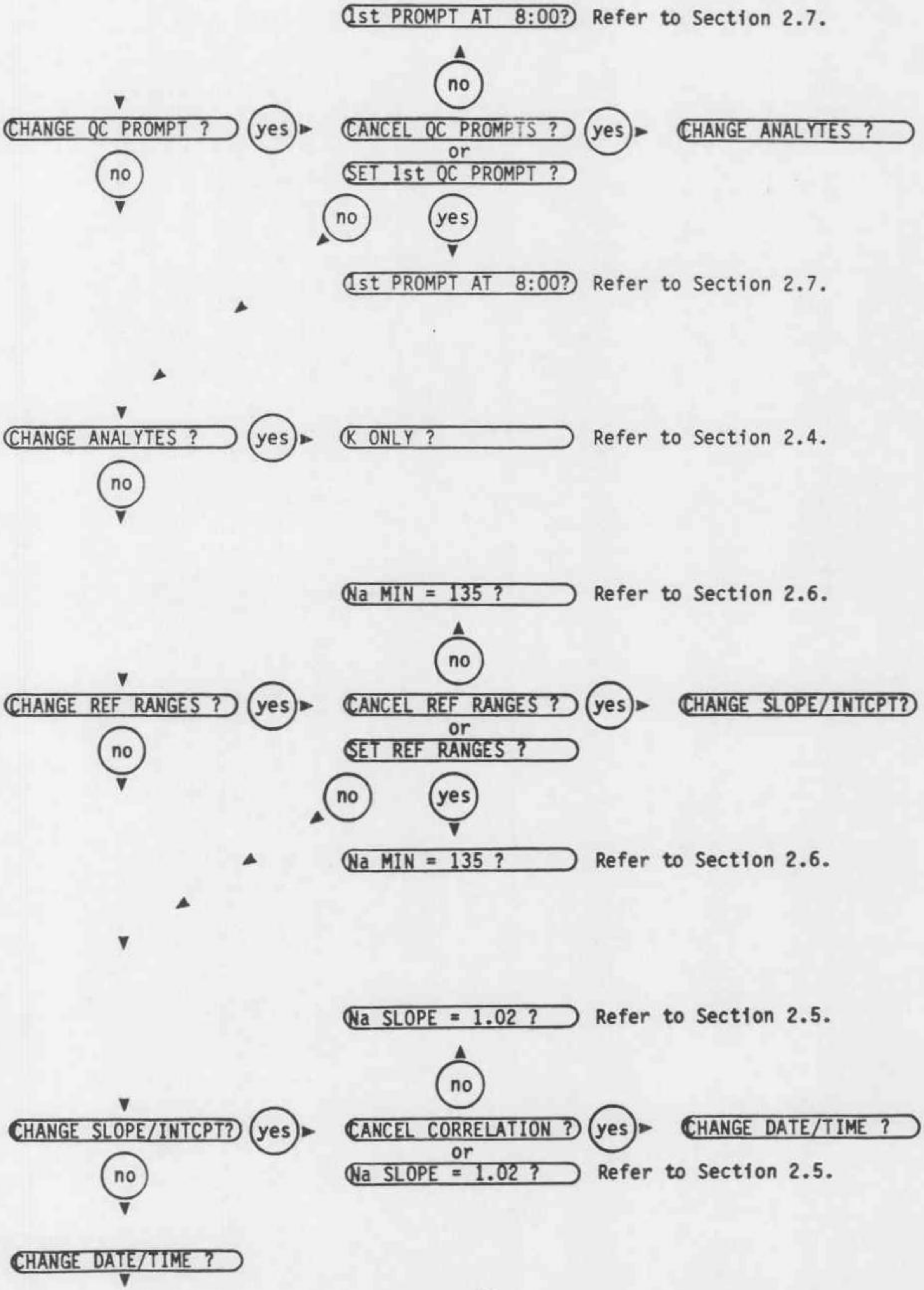
CHANGE QC LIMITS ?
CHANGE QC PROMPT ?
CHANGE REF RANGES ?
CHANGE SLOPE/INTCPT?
CHANGE DMS OPTION ?
CHANGE LANGUAGE ?
CHANGE SECURITY ?

Refer to Section 2.9.

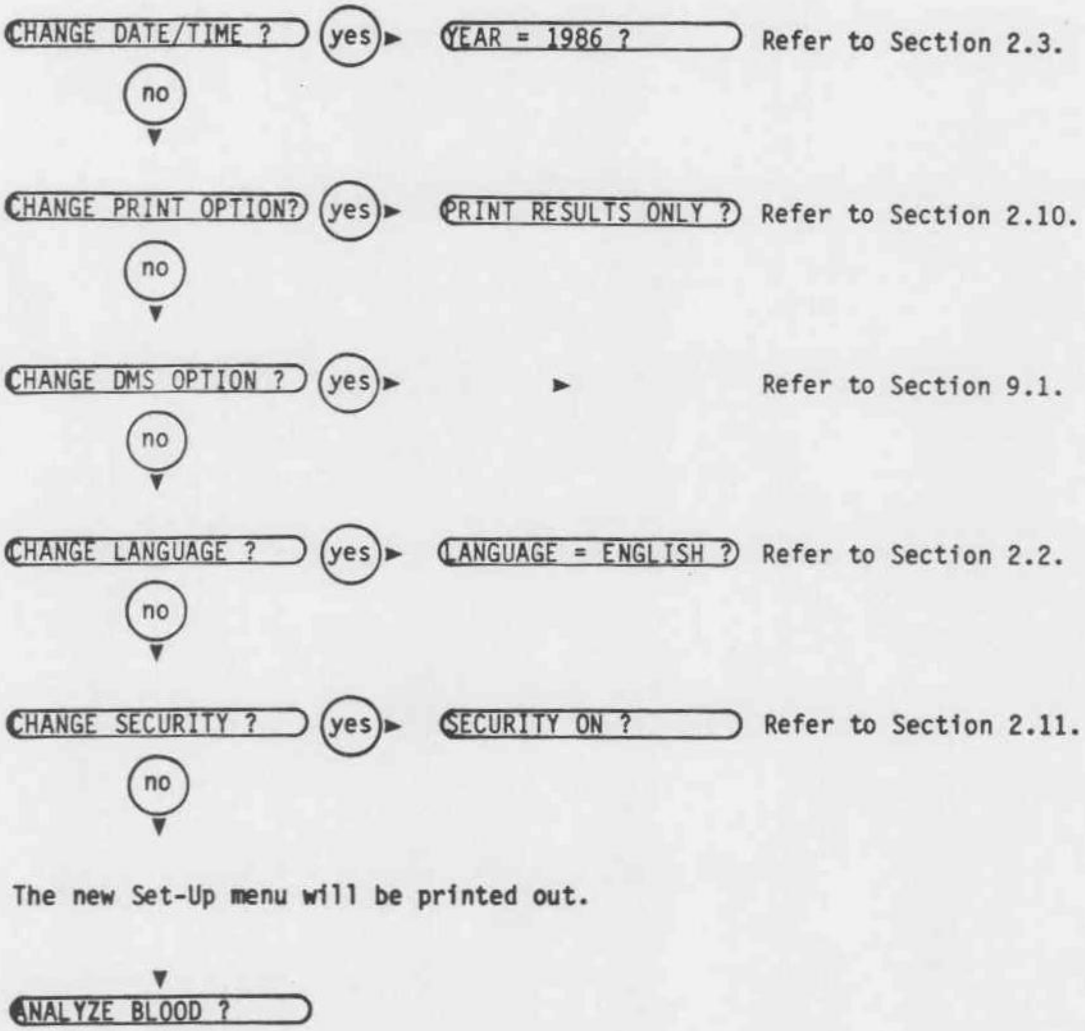
Refer to Section 2.8.

Refer to Section 2.8.

3.1 Menu Routing Maps – Set-Up Menu (cont)


1st PROMPT AT 8:00?
Refer to Section 2.7.
no
CHANGE QC PROMPT ?
yes
CANCEL QC PROMPTS ?
or
SET 1st QC PROMPT ?
yes
CHANGE ANALYTES ?
no
no
yes
1st PROMPT AT 8:00?
Refer to Section 2.7.
CHANGE ANALYTES ?
yes
K ONLY ?
Refer to Section 2.4.
no
Na MIN = 135 ?
Refer to Section 2.6.
no
CHANGE REF RANGES ?
yes
CANCEL REF RANGES ?
or
SET REF RANGES ?
yes
CHANGE SLOPE/INTCPT?
no
no
yes
Na MIN = 135 ?
Refer to Section 2.6.
Na SLOPE = 1.02 ?
Refer to Section 2.5.
no
CHANGE SLOPE/INTCPT?
yes
CANCEL CORRELATION ?
or
Na SLOPE = 1.02 ?
Refer to Section 2.5.
yes
CHANGE DATE/TIME ?
no
CHANGE DATE/TIME ?

3.1 Menu Routing Maps – Set-Up Menu (cont)


CHANGE DATE/TIME ?
yes
YEAR = 1986 ?
Refer to Section 2.3.
no
CHANGE PRINT OPTION?
yes
PRINT RESULTS ONLY ?
Refer to Section 2.10.
no
CHANGE DMS OPTION ?
yes
Refer to Section 9.1.
no
CHANGE LANGUAGE ?
yes
LANGUAGE = ENGLISH ?
Refer to Section 2.2.
no
CHANGE SECURITY ?
yes
SECURITY ON ?
Refer to Section 2.11.
no
The new Set-Up menu will be printed out.
ANALYZE BLOOD ?

3.2 To Measure a Blood, Serum or Plasma Sample

Probe Position Indicators

Capillary

Raise the probe to this position when sampling from capillaries.

Syringe

Raise the probe to this position when sampling from syringes.

Test-tube

Raise the probe to this position when sampling from blood collection tubes, centrifuge tubes, cups, vials or vacutainers™.

Error messages that may appear during this procedure are listed in Section 6.3. An explanation of all instrument messages is given in Appendix A.

ANALYZE BLOOD ?

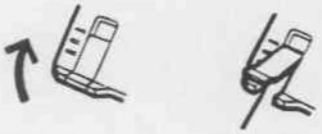
(yes)

▼

If the 614 is in manual standardization mode and more than 10 minutes have elapsed since the last calibration, the instrument will standardize when yes is pressed before allowing sample measurements.

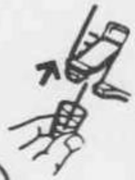
OPEN PROBE

▼



PROBE IN SAMPLE ?

▼

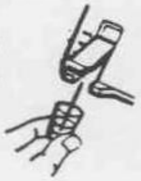


(yes)

SAMPLING

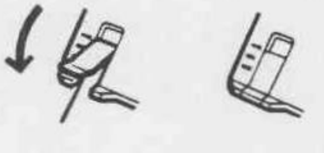
SAMPLING - WAIT

▼



RETURN PROBE

▼



(If the probe is not returned within 10 seconds the tone will sound).

TM Becton, Dickinson, Orangeburg, NY 10962-1294, USA.

3.2 To Measure a Blood, Serum or Plasma Sample (cont)

▼

```
MEASURING
PLEASE WAIT
```

▼

```
BUBBLE - FLUSH ?
```

refer to Section 3.4.

```
Na=145 K=4.20 mmol/L
```

▼

(Example blood, serum or plasma result).

```
ANALYZE BLOOD ?
```

If the 614 is in automatic mode and a calibration is due, this message will be displayed for 15 seconds, then the 614 will calibrate. If yes is pressed within the 15 seconds, sample measurement will continue.

```
                             ==========
                        10:20   MAY   8/86

Calibration result      CAL     OLD    NEW
                        Na      139    140
                        K      4.02   4.00


Slope result            SLOPE   OLD    NEW
                        Na      111    110
                        K      7.99   8.00
                             ==========

                        10:22   MAY   8/86

                        SAMPLE No. = 1

                        BLOOD SAMPLE

Sample result           Na = 145 mmol/L
                        K = 4.20 mmol/L

                             ==========
```

Example Printout for Blood Analysis

3.3 To Measure a Urine Sample

In this mode the urine slope standard and urine samples must be diluted 1 in 10 using Ciba Corning 614 Urine Diluent. The 614 automatically corrects for this dilution factor. A urine slope measurement must be made before sample determinations are carried out.

Error messages that may appear during this procedure are listed in Section 6.3. An explanation of all instrument messages is given in Appendix A.

Ciba Corning recommend that for urine determinations:

(a) a 100 µL pipette is used, as specified in Section 11.2.

(b) 2 mL (nominal) sample cups with caps are used.

(c) the Urine Starter Pack (Cat. 478626, refer to Section 7.2) is used.

(d) for Na^+/K^+ analysis on the 614 urine must not be collected into a strong acid preservative.

1. Refer to the manufacturer's manual supplied with the dispenser and set the volume to 900 µL (0.9 mL).
2. Pipette 100 µL of Urine Slope Standard into a 2 mL sample cup. Add 900 µL of Urine Diluent, using the Ciba Corning diluent dispenser, and cap the sample cup.
3. Pipette 100 µL of sample into another 2 mL sample cup, add 900 µL of Urine Diluent and cap. Repeat for other samples.

CAUTION: Do not leave the solutions exposed to atmosphere, cap immediately, as evaporation will cause an increase in Na^+ and K^+ concentration.

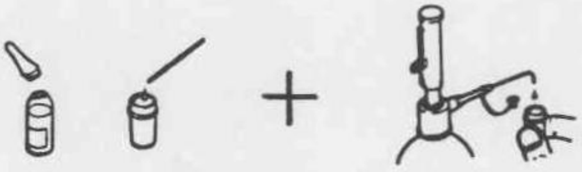
4. Mix the standard and samples by inversion.

URINE ANALYSIS ?

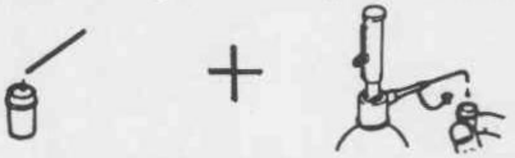
(yes)

▼

SAMP&SLOPE DILUTED ?



100 µL of Urine Slope   900 µL of Urine Diluent



100 µL of Urine Sample   900 µL of Urine Diluent

(yes)

▲

▲

▼

3.3 To Measure a Urine Sample (cont)

▼

CALIBRATING
PLEASE WAIT

▼

If more than 10 minutes have elapsed since the last calibration the 614 will calibrate.

Na=140 K=4.00 mmol/L
CALIBRATION OK

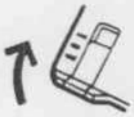
▼

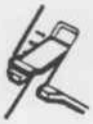
URINE SLOPE ?

yes

▼

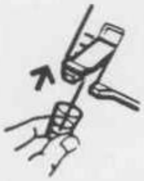
OPEN PROBE





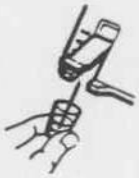
▼

PROBE IN UR. SLOPE ?



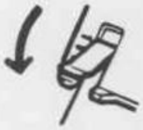
yes

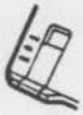
SAMPLING
SAMPLING - WAIT



▼

RETURN PROBE





(If the probe is not returned within 10 seconds the tone will sound).

▼

MEASURING UR. SLOPE
PLEASE WAIT

▼

3.3 To Measure a Urine Sample (cont)

▼

Na=100 K=120 mmol/L
URINE SLOPE OK

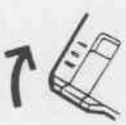
▼

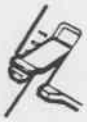
ANALYZE URINE ?

yes

▼

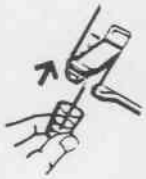
OPEN PROBE





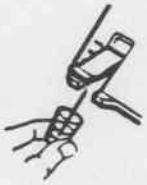
▼

PROBE IN SAMPLE ?



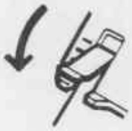
yes

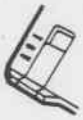
SAMPLING
SAMPLING - WAIT



▼

RETURN PROBE





▼

(If the probe is not returned within 10 seconds the tone will sound).

MEASURING
PLEASE WAIT

▼

BUBBLE - FLUSH ?
refer to Section 3.4.

Na=50 K=60 mmol/L

▼

(Example urine result).

3.3 To Measure a Urine Sample (cont)

```
        ▼
ANALYZE URINE ?
```

```
                             ==========
                         10:48  MAY  8/86

                         CAL     OLD   NEW
                         Na      141   140
                         K      3.98  4.00

Urine slope result       URINE
                         SLOPE   OLD   NEW
                         Na       99   100
                         K       121   120
                             ==========
                         10:50  MAY  8/86

                         SAMPLE No. = 1

                         URINE SAMPLE

Sample result            Na =  50 mmol/L
                         K  =  60 mmol/L

                             ==========
```

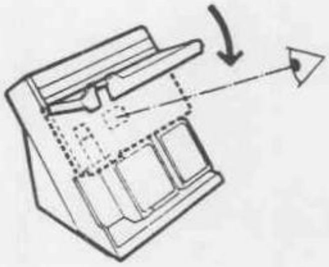
Example Printout for Urine Analysis

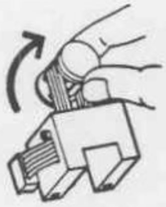
3.4 To Measure or Flush a Sample Containing a Bubble

BUBBLE - FLUSH ?

no
▼

SAMPLE REPOSITIONED?





WARNING: Move sample in the direction indicated only. Samples must not be moved backwards as there is a possibility of KCl from the reference electrode contaminating the K^+ electrode.

yes
▼

MEASURING
PLEASE WAIT
▼

Na=145 K=4.20 mmol/L (Example blood, serum or plasma result).
or
Na= 50 K= 60 mmol/L (Example urine result).
▼

ANALYZE BLOOD ?
or
ANALYZE URINE ?

yes
▼

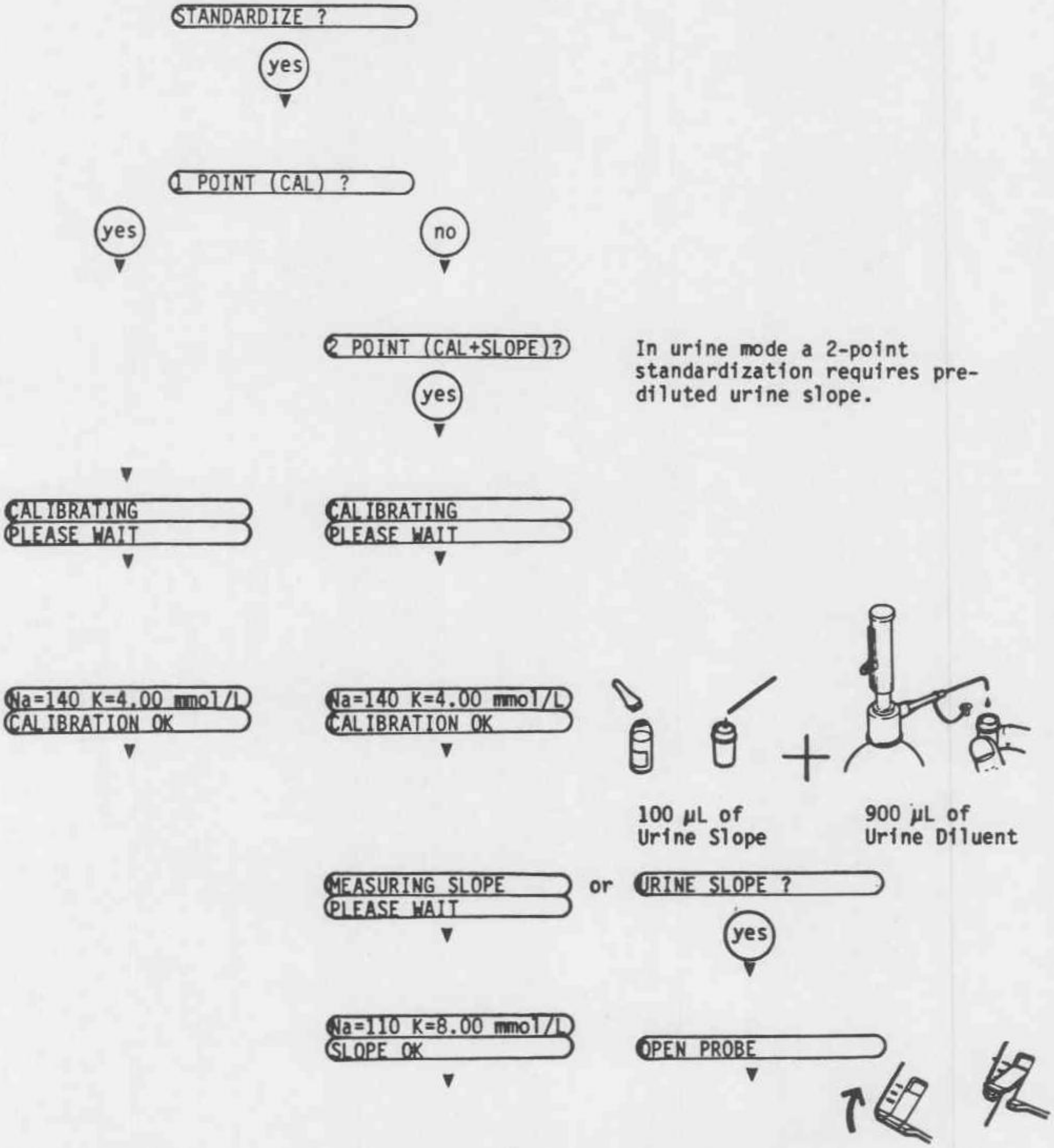
FLUSHING
▼

ANALYZE BLOOD ?
or
ANALYZE URINE ?

3.5 To Manually Standardize the 614

The 614 will automatically standardize as required in both automatic and manual modes. This routine allows manually initiated standardizations to be carried out.

Error messages that may appear during this procedure are listed in Section 6.3. An explanation of all instrument messages is given in Appendix A.


STANDARDIZE ?
yes
1 POINT (CAL) ?
yes
no
2 POINT (CAL+SLOPE)?
yes
CALIBRATING
PLEASE WAIT
CALIBRATING
PLEASE WAIT
Na=140 K=4.00 mmol/L
CALIBRATION OK
Na=140 K=4.00 mmol/L
CALIBRATION OK
100 µL of Urine Slope
900 µL of Urine Diluent
MEASURING SLOPE
PLEASE WAIT
or
URINE SLOPE ?
yes
Na=110 K=8.00 mmol/L
SLOPE OK
OPEN PROBE

In urine mode a 2-point standardization requires pre-diluted urine slope.

3.5 To Manually Standardize the 614 (cont)

▼

ANALYZE BLOOD ?

or

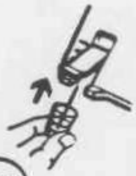
ANALYZE URINE ?

▼

ANALYZE BLOOD ?

▼

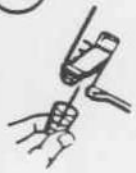
PROBE IN UR. SLOPE ?



yes

SAMPLING

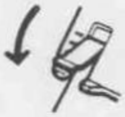
SAMPLING - WAIT

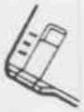


▼

RETURN PROBE

▼





MEASURING UR. SLOPE

PLEASE WAIT

▼

Na=100 K=120 mmol/L

URINE SLOPE OK

▼

ANALYZE URINE ?

3.6 To Recall the Last Result

LAST RESULT RECALL ?

yes

▼

Na=145 K=4.20 mmol/L

or

Na= 50 K= 60 mmol/L

▼

(Example blood, serum or plasma result).

(Example urine result).

The printout will show the time the sample was analyzed, not the time it was recalled. If no sample measurements have been performed, the display will read NO DATA AVAILABLE.

ANALYZE BLOOD ?

or

ANALYZE URINE ?

3.7 To Measure a QC Sample

The 614 can automatically prompt a QC check by displaying QC NOW ? up to three times a day. QC checks can also be initiated manually by accessing QC NOW ? in the Check/Service menu (if QC Limits have been set, Section 2.8). If a manual QC NOW ? is performed during the hour preceding a QC prompt, that QC prompt will be suppressed.

Error messages that may appear during this procedure are listed in Section 6.3. An explanation of all instrument messages is given in Appendix A.

QC NOW ?

yes

▼

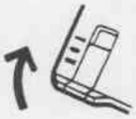
If the 614 is in manual standardization mode and more than 10 minutes have elapsed since the last calibration, the instrument will standardize when yes is pressed before allowing QC measurements.

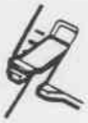
LOW QC ?

yes

▼

OPEN PROBE

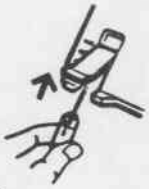




yes

▼

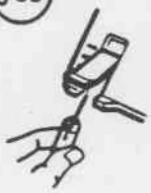
PROBE IN LOW QC ?



yes

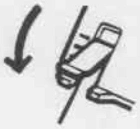
SAMPLING

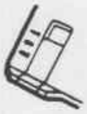
SAMPLING - WAIT



▼

RETURN PROBE





▼

(If the probe is not returned within 10 seconds the tone will sound).

3.7 To Measure a QC Sample (cont)

▼

MEASURING
PLEASE WAIT

▼

LOW QC:Na=117 K=3.10

(Example LOW QC result).
If the result is outside preset limits or unstable, the 614 will return to LOW QC ? to allow the QC measurement to be repeated. If it is within limits the 614 will display MID QC ?.

▼

MID QC ?

The procedure for measuring MID and HIGH QC is the same as the LOW QC ? routine, except the messages will read MID or HIGH accordingly.

3.8 To Shutdown the 614

Ciba Corning recommend that the 614 is connected to the a.c. supply at all times so that it is always ready for immediate use. However, if it is necessary to disconnect the a.c. supply this procedure should be followed to prevent damage to the instrument.

Printout the Set-Up menu parameters.

RETURN TO SET-UP ? (yes) ► PRINTING SET-UP

The 614 will print out the Set-Up menu - retain for future reference. Press no to all Set-Up menu questions.

Disinfect the sample path, Section 5.5.

Disinfect the manifold and bottle tubing.

DRAIN ?

(yes)

▼

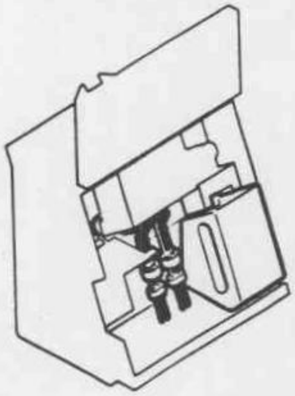
CAL-PAK REMOVED ?

(yes)

▼

WAIT - DRAINING

▼



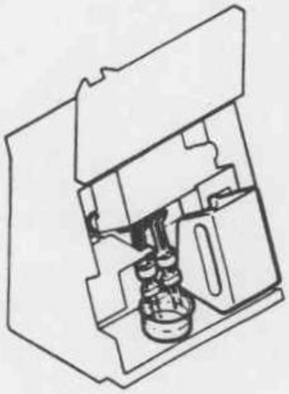
DRAINING COMPLETED
CAL-PAK REPLACED ?

(yes)

▼

WAIT - PRIMING

▼



NOTE: Beaker contains 2% activated glutaraldehyde solution (do not add other decontaminants, e.g. hypochlorite).

3.8 To Shutdown the 614 (cont)

PRIME AGAIN ?

yes ▼

AUTO PRIME ? no ► MANUAL PRIME ?

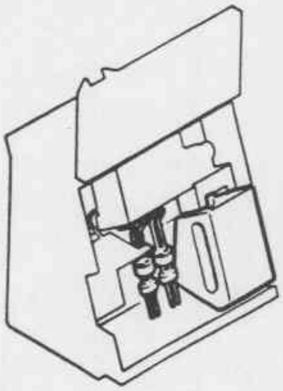
yes ► Press and hold until solution flows into waste bottle, then press

no

Drain the manifold and bottle tubing.

DRAIN ?

yes ▼



CAL-PAK REMOVED ?

yes ▼

WAIT - DRAINING

▼

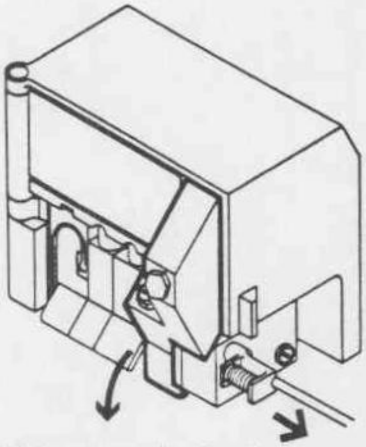
DRAINING COMPLETED
CAL-PAK REPLACED ?

Remove the waste bottle and cap it.

Disconnect the line cord from the power supply socket.

Remove the probe and tubing, Section 5.14, and immerse in 2% activated glutaraldehyde solution for 10 minutes. Reassemble.

3.8 To Shutdown the 614 (cont)



Remove the reference electrode. If the reference electrode is to be removed from the instrument for more than 12 hours this procedure should be followed to prevent damage to the electrode cassette and Nafion™ inner:

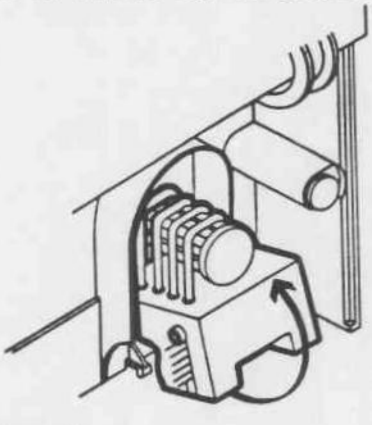
Remove Nafion™ inner and store in its container in saturated KCl. DO NOT leave the inner out of solution for longer than 10 minutes.

Shake out the remaining KCl solution from the electrode cassette and rinse with deionized water.

Flush the reference electrode sample path with deionized water, and allow cassette to dry.

NOTE: To reactivate the reference electrode follow the procedure for installing a new electrode, Section 5.12.

Wipe the electrode block to remove any reference electrode fill solution.



Release the pump tube cassette.

Clean the weir cover, Section 5.8.

Wipe the probe, weir, sample area, calibrant compartment and external surfaces with clean tissues moistened with 2% activated glutaraldehyde solution.

TM Dupont, Wilmington, Delaware, USA.

4.1 Operating Precautions

1. The 614 is designed to be left connected to an a.c. supply. Do not leave it switched off unless Section 3.8 has been followed to prevent damage to the 614.

2. Do not measure flame photometer standards on the 614 as they contain viscosity compensation agents that will damage the electrodes.

3. Never turn the pump rotor counterclockwise as there is a possibility of KCl from the reference electrode contaminating the K^+ electrode. When repositioning samples they should be moved forwards until there are no air bubbles beneath the electrodes, and the sample is under all three electrodes.

4. Use Ciba Corning sample collection devices as the specially formulated heparin coating will not affect sample results.

5. Some QC materials contain substances which are known to damage electrodes, or affect electrode response. Do not use any QC material containing ethylene glycol, caesium ions or excessive amounts of ammonium ions.

6. Make sure that whole blood samples are:
   - only heparinized with lithium heparin of the specified type and the correct level, see Section 4.3
   - kept at room temperature, do not refrigerate.
   - measured as soon as possible, and not more than one hour after collection from the patient.

7. Make sure that great care is taken when obtaining and handling whole blood samples, as haemolysis will cause an increase in potassium readings. Refer to Section 4.3.

8. The 614 Na^+ electrode response will not change if the pH of standards and samples is between 7.1 and 7.7. Beyond these limits response changes rapidly with pH.

9. Make sure that only Ciba Corning reagents and supplies are used with the 614. Do not use solutions after the expiration date shown on the label. Do not decant solutions from one bottle to another as this can cause contamination. Agitate the Cal-Pak daily, to incorporate any solution that may have condensed on to the inside surfaces of the bottles. It is advisable to empty the waste bottle daily and add approximately 10 mL of disinfectant or sodium hypochlorite to the bottle. When replacing the Cal-Pak always remove the waste bottle and put the empty Cal/Flush bottle in its place. Ciba Corning recommend that approximately 10 mL of disinfectant or hypochlorite is put into the empty Cal/Flush bottle before placing it in position as the waste bottle.

10. The sample area cover is electrostatically screened. Do not operate the instrument with the cover raised or removed.

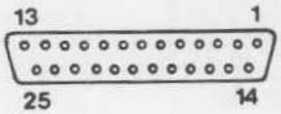
4.1 Operating Precautions (cont)

11. Do not release the electrode clamp unless the instrument has been stopped using the (SYSTEM STOP ?) or (DRAIN ?) routines.

12. Make sure that routine maintenance is carried out at the intervals stated in Section 5.

13. The maximum non-destructive voltage that can be applied to the data output and peripherals control sockets is +5V d.c. The only exceptions to this are pins 3 and 11 of the data output socket which may have a maximum of ±12V d.c. applied (data receive connections).

data output



Pin	Signal	Pin	Signal
1	protective ground	11	20 mA Rx +ve
2	RS232 Tx	12 & 13	not used
3	RS232 Rx	14	+12V
4 & 5	not used	15 to 17	not used
6	security link	18	-12V
7	RS232 0V	19 to 23	not used
8	20 mA Tx -ve	24	security link
9	20 mA Tx +ve	25	+5V
10	20 mA Rx -ve		

4.2 Hazards

1. There are no user replaceable parts within the instrument. Do not remove the cover from the 614.

2. All samples should be treated with the caution accorded to those known to contain pathogenic organisms.

3. Make sure that before handling the component parts of the 614 (such as the probe, electrodes, electrode block, pump tube cassette and waste bottle) the instrument has been disinfected, Section 5.5.

4. Ciba Corning Conditioner contains 0.1M Ammonium bifluoride (Ammonium hydrogen difluoride) which is toxic if swallowed and will cause burns if in contact with skin. In case of contact with eyes rinse immediately with plenty of water and seek expert medical advice. Clean up spillages immediately and wash with plenty of water.

5. Make sure that the manufacturer's directions for use are followed when using disinfectant.

4.3 Sample Handling and Collection

Blood Samples

WARNING: Blood sample procurement must be performed under proper medical supervision, including site selection, specific procedures utilized, and sample handling documentation. Sterile technique is required at all times to avoid infection of the puncture site.

Arterial, venous or capillary blood samples are suitable for sodium and potassium determinations. Make sure that great care is taken when collecting and handling these samples, as haemolysis will cause an increase in potassium readings and the instrument will not detect haemolysis.

Routinely, arterial punctures may be performed on a radial, brachial, or femoral artery. Other sites are also used following catheterization or surgical procedures.

Capillary blood may be obtained from the heel, finger or earlobe. The area chosen should be pre-warmed or otherwise stimulated to promote arterial circulation before performing the capillary puncture. The puncture should be deep enough to make sure that the blood flow is free and rapid. Venous samples are commonly obtained using vacuum tubes or heparinized syringes.

The specific details of any collection must be approved by the medical person responsible. The above are not specific procedures, but are only indicative of some of the precautions required. Some procedural references are included at the end of this section.

WARNING: Lithium heparin is the only anti-coagulant that should be used with blood samples. Do not use sodium heparin. Other common anti-coagulants, e.g. EDTA, citrate, oxalate and fluoride may have significant effects on readings and, therefore, should not be used.

Syringe Samples

Blood collected in heparinized, airtight glass or plastic syringes will be satisfactory for use with the 614. Use only lithium heparin at 15 to 50 International units/mL of sample. Higher concentrations will depress Na^+ and K^+ results, as heparin is known to bind ions, unless the heparin is specially modified, as in Ciba Corning capillaries. The syringe must be filled completely, as incomplete filling will raise the level of lithium heparin with respect to the sample.

Capillary Samples

Capillary blood should be collected using Ciba Corning capillary tubes (refer to Section 7 for ordering information). The 614 requires 35 µL of sample in the electrode block. The capillary tube should be filled completely for accurate measurements, and the ends securely capped. Ciba Corning capillary tubes have approximately 150 International units of lithium heparin/mL of sample. This level has been carefully chosen to prevent clotting, without the use of a mixing flea, and the heparin has been specially modified to give minimal interference with readings.

Vacuum, Blood Collection and Centrifuge Tubes

These tubes should be filled to the recommended mark before use.

Sample Storage

Plasma and serum should be prepared immediately and stored in a refrigerator. Refrigerated samples can be inserted directly into the 614.

Whole blood should be analyzed immediately, and definitely within one hour of collection, to avoid any possibility of increased potassium readings. Whole blood must only be kept at room temperature, do not chill or refrigerate.

Urine Samples

Urine samples for Na and K analysis are usually collected as timed 24 hour specimens, or less commonly as random urine specimens. 24 hour urine collections may be made using a preservative such as thiomersalate or without preservative if analysis can be made within a few hours of completing the collection. Do not use hydrochloric or other acids as preservative in the collection bottle. The presence of hydrogen ions, resulting in a final diluted urine test solution with a pH of less than 6.5, will affect the performance of the Na electrode.

References

Felkner, D. A protocol for teaching and maintaining arterial puncture skills among respiratory therapists. Resp. Care 1973; 18:6: 700-705.

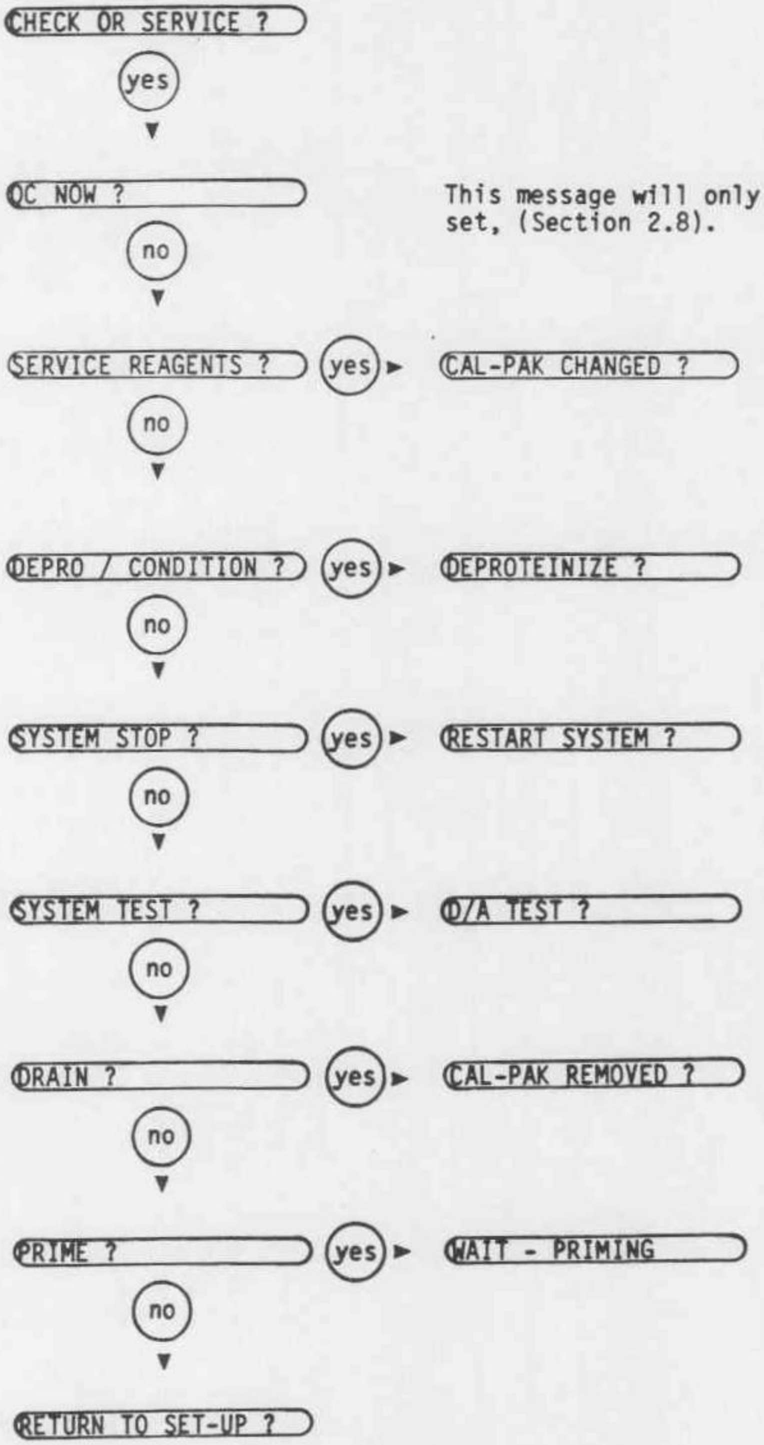
Meites, S, Levitt, MJ. Skin-puncture and blood collecting techniques for infants. Clin Chem 1979; 25:1: 183-189.

Standard procedures for the collection of diagnostic blood specimens by venipuncture. NCCLS ASH-3, 1980.

Standard for specimen collection: Part 2. Blood specimen by venipuncture. ECCLS 1985;5:5.

5.1 Check/Service Menu Map

The menu map will help users access the routines in the Check/Service menu.


CHECK OR SERVICE ?
yes
QC NOW ?
no
SERVICE REAGENTS ?
yes
CAL-PAK CHANGED ?
no
DEPRO / CONDITION ?
yes
DEPROTEINIZE ?
no
SYSTEM STOP ?
yes
RESTART SYSTEM ?
no
SYSTEM TEST ?
yes
D/A TEST ?
no
DRAIN ?
yes
CAL-PAK REMOVED ?
no
PRIME ?
yes
WAIT - PRIMING
no
RETURN TO SET-UP ?

This message will only appear if QC Limits have been set, (Section 2.8).

If SYSTEM TEST ? is entered from ANALYZE URINE ?, part of the routine, the electrode output test, will not be accessible.

5.2 General

The 614 has been designed to reduce the need for regular maintenance to an absolute minimum. The maintenance required is detailed in Sections 5.3 and 5.4.

WARNING: Before carrying out certain maintenance routines, the 614 MUST BE disinfected. Refer to Section 5.5, To Disinfect the 614, for full details of this procedure.

The routines requiring disinfection are:

Section 5.11, Replacing the pump tube cassette, cleaning and lubricating the rollers
Section 5.12 Replacing the reference electrode cassette
Section 5.13 Filling/replacing the Na^+ and K^+ electrodes
Section 5.14, Replacing the probe, probe tubing and waste tube
Section 5.16, Replacing the probe micro switch
Section 5.17, Replacing the manifold and solenoids
Section 5.18, Replacing the sample detectors
Section 5.19, Replacing the slope inlet block

Maintenance should be carried out with the instrument functions 'suspended', using either the DRAIN ? or SYSTEM STOP ? routines.

Use the DRAIN ? routine for:

Section 5.11, Replacing the pump tube cassette, cleaning and lubricating the rollers
Section 5.15 Replacing the connecting tubing
Section 5.17, Replacing the manifold and solenoids

Use the SYSTEM STOP ? routine for:

Section 5.12, Replacing the reference electrode cassette
Section 5.13, Filling/replacing the Na^+ and K^+ electrodes
Section 5.14, Replacing the probe, probe tubing and waste tube
Section 5.16, Replacing the probe micro switch
Section 5.18, Replacing the sample detectors
Section 5.19, Replacing the slope inlet block

5.3 Scheduled Maintenance

Daily Maintenance

Equipment
Cal-Pak, as required; 2% activated glutaraldehyde solution (eg. CIDEX™); Clean tissues.

NOTE: Do not add other decontaminants, e.g. hypochlorite, to the glutaraldehyde solution.

1. Check levels of calibrants and replace with new Cal-Pak if necessary, Section 5.4. The Cal-Pak will probably need replacing once a week.

2. Check that the probe is straight and centered over the weir when in the closed position. Realign or replace if necessary, Section 5.14.

3. Wipe the sample area, calibrant compartment and the external surfaces with clean tissues moistened with 2% activated glutaraldehyde solution.

4. Clean the weir cover, Section 5.8.

Three monthly (Quarterly) Maintenance

Equipment
Items listed under Daily maintenance; pump tube cassette; weir cover, as required; reference electrode cassette; $Na^+/K^+/Ca^{++}$ electrode fill solution, as required.

Carry out daily maintenance and:

1. Disinfect the 614, Section 5.5.

2. Replace the weir cover, if necessary, Section 5.8.

3. Replace the pump tube cassette, and clean and lubricate the roller assembly, Section 5.11.

4. Replace the reference electrode cassette (not the inner electrode), Section 5.12.

5. Check Na^+ and K^+ electrode fill solution and refill the electrodes if necessary, Section 5.13.

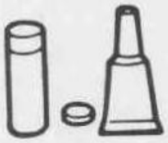
TM Surgikos Ltd., Livingston, Scotland.

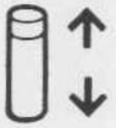
5.4 To Change the Cal-Pak, Deproteinize and Condition the Electrodes

Equipment
Cal-Pak, Deproteinizer (D) and Conditioner (C), Cat. 478541; or Deproteinizer and Conditioner multi packs, Cat. 478700 and 478701.

This Section also shows the procedure for deproteinizing/conditioning the electrodes using the (DEPRO / CONDITION ?) routine.

NOTE: Activate the Deproteinizer with a pepsin tablet before starting this procedure, as the tablet will take between 10 and 15 minutes to dissolve.





Cap and shake the vial until the pepsin tablet has dissolved, or leave to stand for 15 minutes. The pepsin tablet must be completely dissolved before the solution is used.

If you are deproteinizing and/or conditioning the electrodes and not changing the Cal-Pak, the routine starts on the next page, at (DEPRO / CONDITION ?).

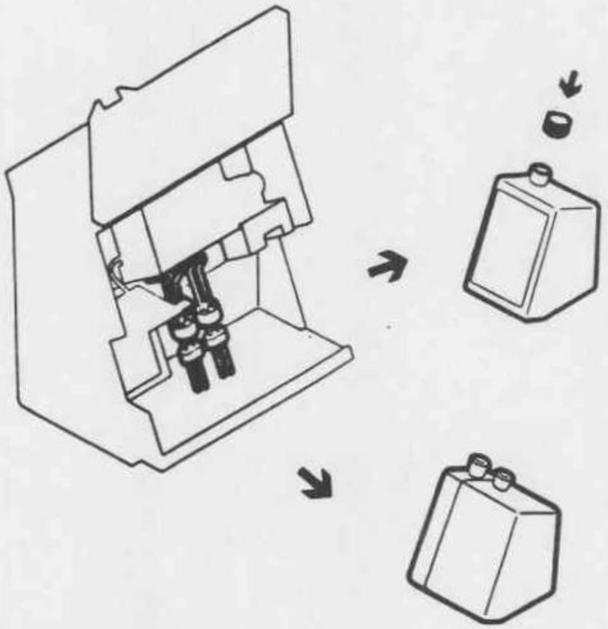
(SERVICE REAGENTS ?)

(yes)

▼

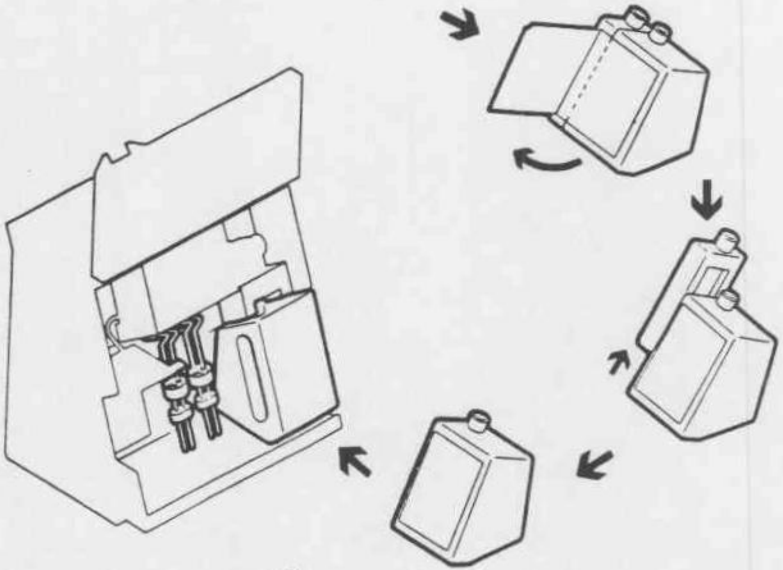
(CAL-PAK CHANGED ?)

▼

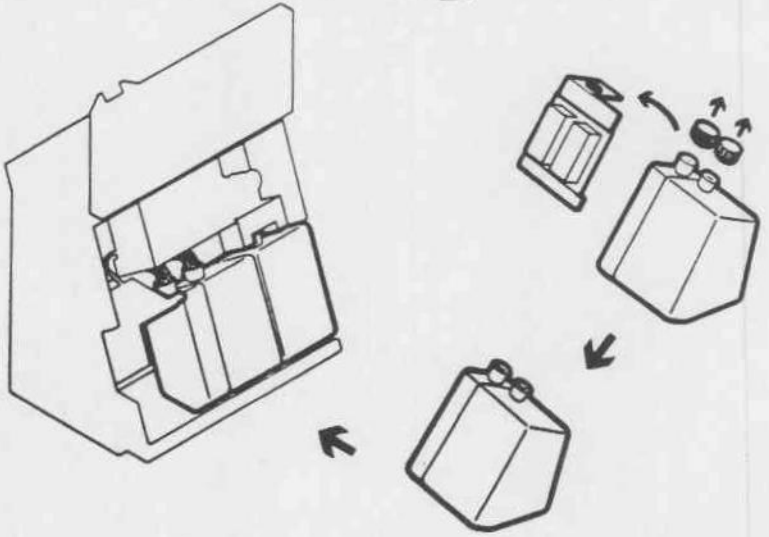


5.4 To Change the Cal-Pak, Deproteinize and Condition the Electrodes (cont)

▼



▼



▼

(yes)

▼

WAIT - PRIMING

▼

If you have not changed the Cal-Pak and are deproteinizing and/or conditioning the electrodes using the DEPRO / CONDITION ? routine, start here. If the Cal-Pak has been changed, continue with DEPROTEINIZE ? .

DEPRO / CONDITION ?

(yes)

▼

This message will not be displayed in the SERVICE REAGENTS ? routine.

DEPROTEINIZE ?

(yes)

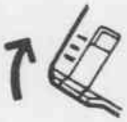
▼

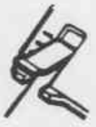
5.4 To Change the Cal-Pak, Deproteinize and Condition the Electrodes (cont)

▼

OPEN PROBE

▼

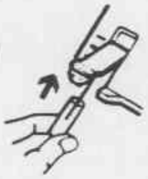




PROBE IN SOLN D ?

(yes)

▼

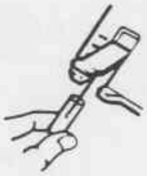


NOTE: SOLN D = Activated deproteinizer.

SAMPLING

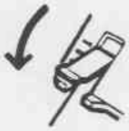
SAMPLING - WAIT

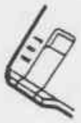
▼



RETURN PROBE

▼





DEPROTEINIZING

WAIT 5:00 MINUTES (counts down to zero)

▼

If it is essential to measure a sample during this routine, press

(no)

▼

FLUSHING

▼

CONDITION ?

(no)

▼

The 614 will standardize

▼

ANALYZE BLOOD ?

When sample measurement is complete repeat the deproteinizing routine.

▼

CONDITION ?

(yes)

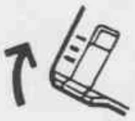
▼

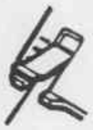
5.4 To Change the Cal-Pak, Deproteinize and Condition the Electrodes (cont)

▼

OPEN PROBE

▼

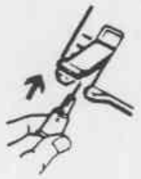




PROBE IN SOLN C ?

yes

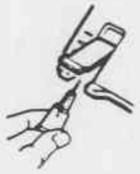
▼



NOTE: SOLN C = Conditioner.

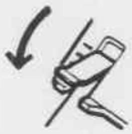
SAMPLING
SAMPLING - WAIT

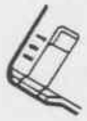
▼



RETURN PROBE

▼





CONDITIONING
WAIT 5:00 MINUTES (counts down to zero)

▼

If it is essential to measure a sample during this routine press

no

▼

The 614 will flush then standardize

▼

ANALYZE BLOOD ?

When sample measurement is complete repeat the conditioning routine.

▼

FLUSHING

▼

The 614 will now carry out an automatic standardization.

▼

ANALYZE BLOOD ?

5.5 To Disinfect the 614

Equipment
Disinfectant - 2% activated glutaraldehyde solution (e.g. CIDEX™).

NOTE: Do not add other decontaminants, e.g. hypochlorite, to the glutaraldehyde solution.

WARNING: This procedure disinfects the 614 sample path and should always be done before replacing the pump tube cassette, connecting tubing etc., refer to Section 5.2. It should also be carried out after analyzing a sample known or suspected to contain dangerous pathogens.

The (DEPRO / CONDITION ?) routine is used to disinfect the 614.

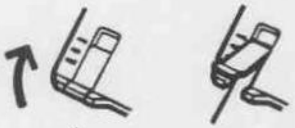
(DEPRO / CONDITION ?)

(yes)
▼

(DEPROTEINIZE ?)

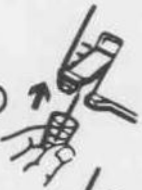
(yes)
▼

(OPEN PROBE)



▼

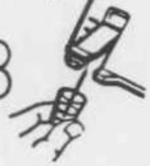
(PROBE IN SOLN D ?)



NOTE: In this routine, SOLN D is disinfectant.

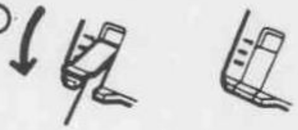
(yes)
▼

(SAMPLING)
(SAMPLING - WAIT)



▼

(RETURN PROBE)



▼

(DEPROTEINIZING)
(WAIT 5:00 MINUTES) (counts down to zero)
▼

If it is essential to measure a sample during this routine, press

(no)
▼

TM Surgikos Ltd., Livingston, Scotland.

5.5 To Disinfect the 614 (cont)

▼

▼

CONDITION ?

yes

▼

OPEN PROBE

▼

PROBE IN SOLN C ?

yes

▼

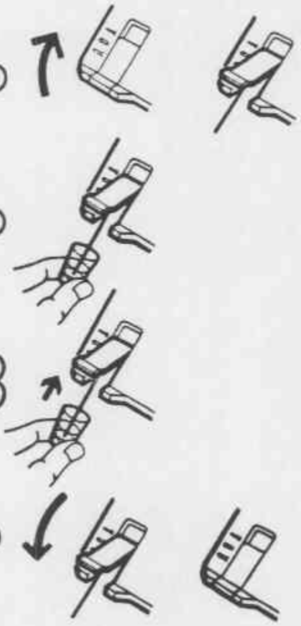
SAMPLING

SAMPLING - WAIT

▼

RETURN PROBE

▼



CONDITIONING

WAIT 5:00 MINUTES (counts down to zero)

▼

▼

The 614 will flush then standardize

▼

ANALYZE BLOOD ?

▼

FLUSHING

▼

CONDITION ?

no

▼

The 614 will standardize

▼

ANALYZE BLOOD ?

NOTE: In this routine, SOLN C is disinfectant.

If it is essential to measure a sample during this routine press

no

▼

The 614 will flush then standardize

▼

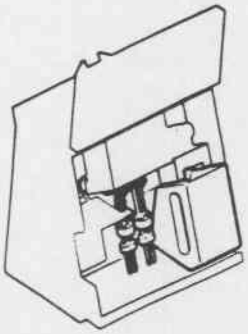
ANALYZE BLOOD ?

5.6 Drain Routine

Use this routine when replacing the pump tube cassette, connecting tubing, manifold and solenoids.

DRAIN ?

(yes) ▼



CAL-PAK REMOVED ?

(yes) ▼

WAIT - DRAINING

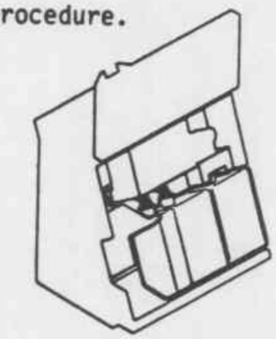
▼

DRAINING COMPLETED
CAL-PAK REPLACED ?

▼

Carry out the maintenance procedure.

CAUTION: Do not leave the 614 in this mode for longer than is required to carry out the maintenance procedure.



(yes) ▼

WAIT - PRIMING

▼

PRIME AGAIN ? (yes) ► AUTO PRIME ? (yes) ► WAIT - PRIMING

AUTO PRIME ? (no) ▼ MANUAL PRIME (yes) ► Press and hold until solution flows into the waste bottle, then press (no)

PRIME AGAIN ? (no) ▼

The 614 will now carry out an automatic standardization.

▼

ANALYZE BLOOD ?

5.7 System Stop Routine

Use this routine when replacing the electrodes, probe and tubing, micro switch, sample detectors, slope inlet block, or when clearing blockages.

`SYSTEM STOP ?`

(yes)

▼

`RESTART SYSTEM ?`

▼

CAUTION: Do not leave the 614 in this mode for longer than is required to carry out the maintenance procedure.

Carry out the maintenance procedure.

(yes)

▼

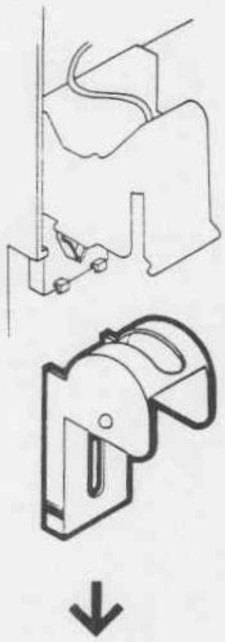
The 614 will now carry out an automatic standardization.

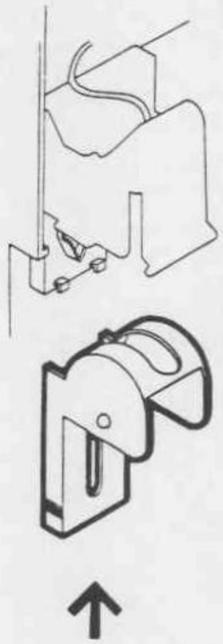
▼

`ANALYZE BLOOD ?`

5.8 To Clean/Replace the Weir Cover

Equipment
Disinfectant - 2% activated glutaraldehyde (e.g. CIDEX^{TM}); Clean tissues; Weir cover, Cat.478633, as required.





To clean the weir cover, wipe with clean tissues moistened with disinfectant.

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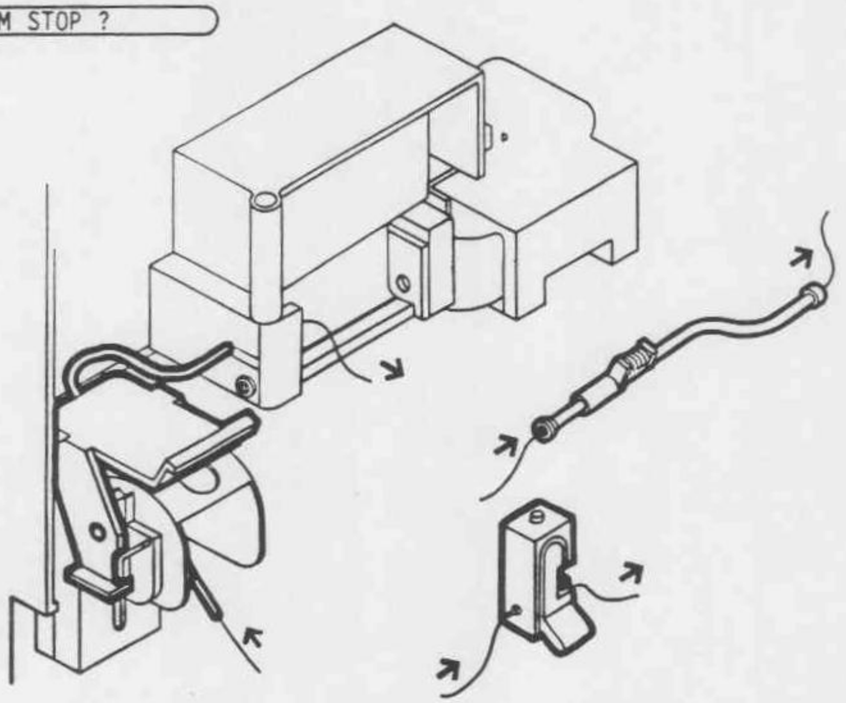
5.9 To Clear Blockages

Equipment
Clot removal line, Cat. 478645; 1 mL syringe, as required.

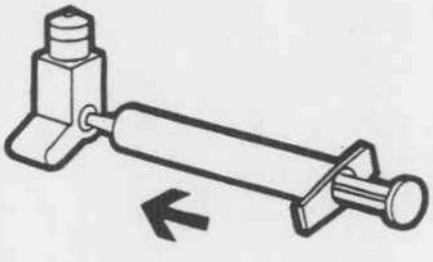
WARNING: Always wear protective gloves when carrying out this procedure.

CAUTION: Only use Ciba Corning clot removal line during this procedure as other materials may damage the 614.

Select (SYSTEM STOP ?)

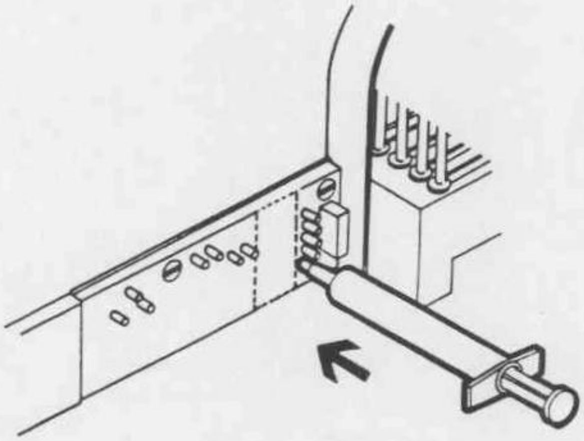


To clear a blockage in the probe, probe tubing or waste tube.



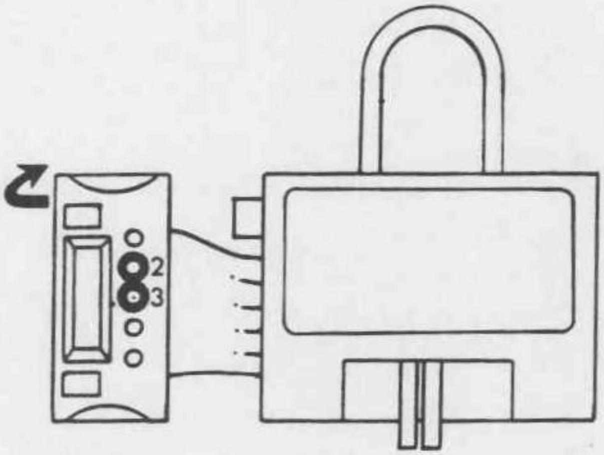
To clear a blockage in the K$^+$, Na$^+$ or reference electrode. Deionized water may be used.

5.9 To Clear Blockages (cont)



bottom port on manifold

To clear a blockage in the weir drain hole or manifold.



To clear a blockage in the pump tube cassette, inject approximately 5 mL of deionized water into ports 2 and 3, followed by air to remove the water. Hold the cassette block away from you during this procedure.

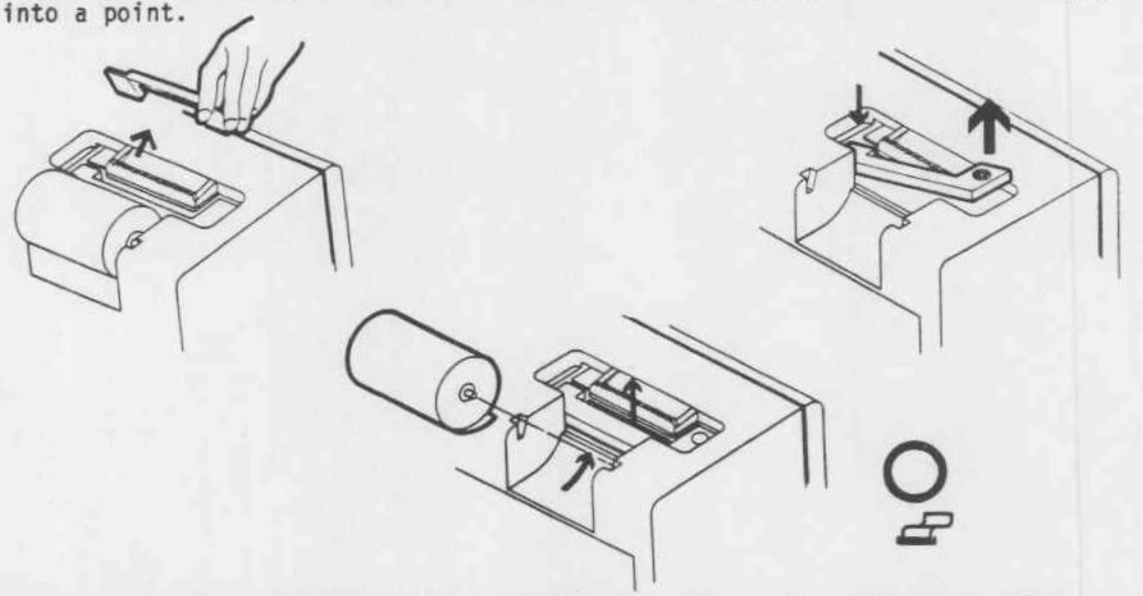
Deproteinize the electrodes, Section 5.4.

5.10 To Replace the Printer Paper and Ribbon

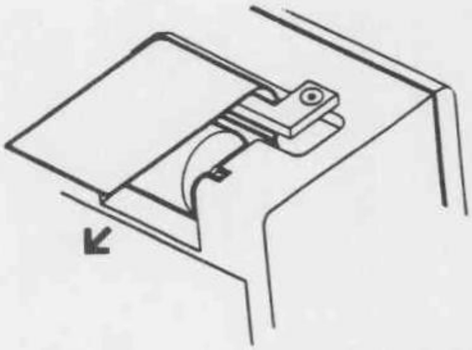
Equipment
Printer paper, Cat. 478638; Printer ribbon cassette, Cat. 478637.

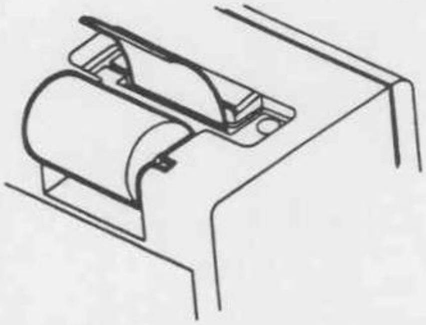
NOTE: To clear a paper jam, tear the paper and remove the paper roll. Press ○ to advance the piece of paper through the printer. If this is not possible, pull the piece of paper towards you out of the printer.

Before loading the new paper roll, remove accumulated paper dust with a soft brush, or by blowing. Loading the paper may be made easier by cutting the end of the paper roll into a point.



NOTE: Fit a new ribbon cassette at every printer paper change. Make sure the printer paper is in place before fitting the printer ribbon cassette.





Pull the printer paper tight towards the rear of the 614 and feed the paper between the ribbon and the cassette. Holding the paper taut, slide the cassette towards the front of the 614, then press down to lock it into place.

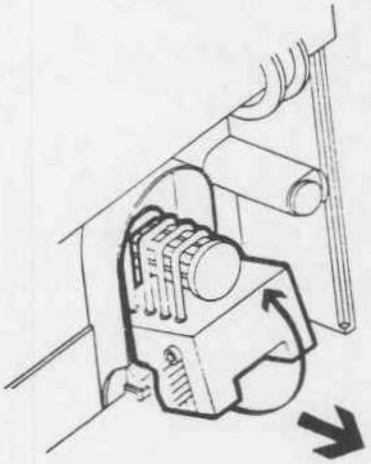
Replace the printer cover.

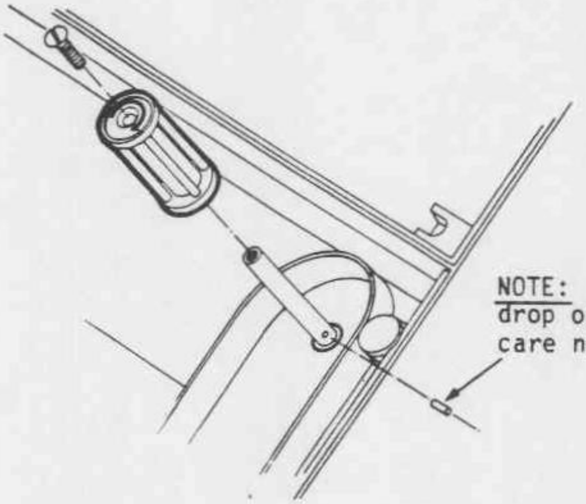
Check that the paper feeds correctly by pressing ○ . Carry out a display and printer test, Section 5.21, to check that the printout is clear.

5.11 To Replace the Pump Tube Cassette, Clean and Lubricate the Rollers

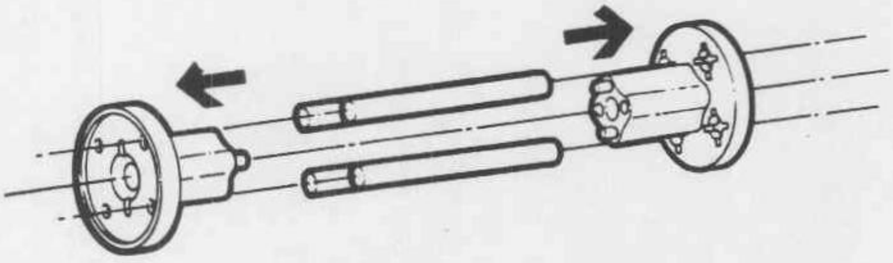
Equipment
Disinfectant; Pump tube cassette, Cat.478639; Screwdriver, supplied with Installation Pack; Mild detergent; Silicone grease (e.g. Dow Corning Compound 7™); Clean tissues.

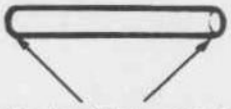
Disinfect and drain the 614.





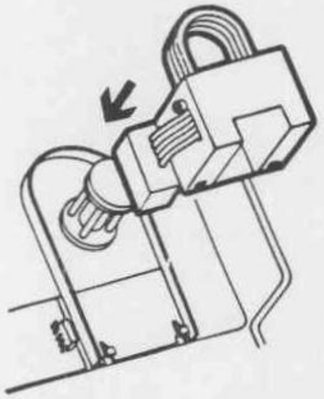
NOTE: Pin may drop out. Take care not to lose.

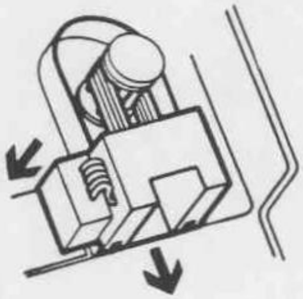




Lubrication points

Wash the rotor assembly in mild detergent solution, rinse and dry with tissues. Lightly lubricate each roller at the points shown. Reassemble.





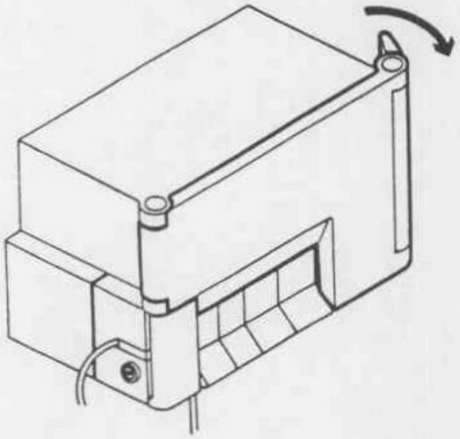
Date the pump tube cassette label three months ahead.

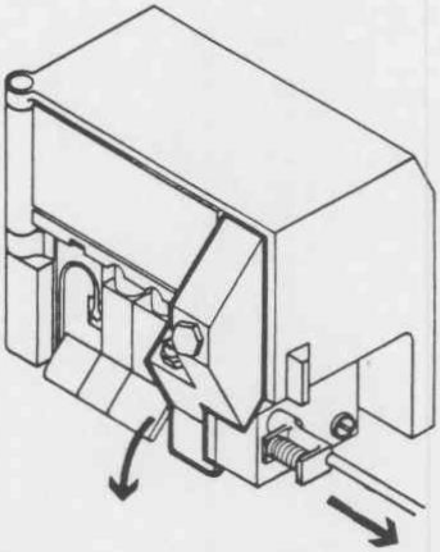
TM NV Dow Corning S.A., Belgium.

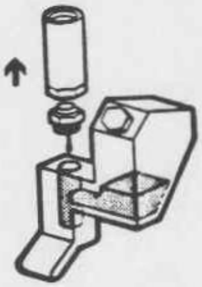
5.12 To Replace the Reference Electrode Cassette

Equipment
Disinfectant; Reference electrode refill, Cat. 478498.

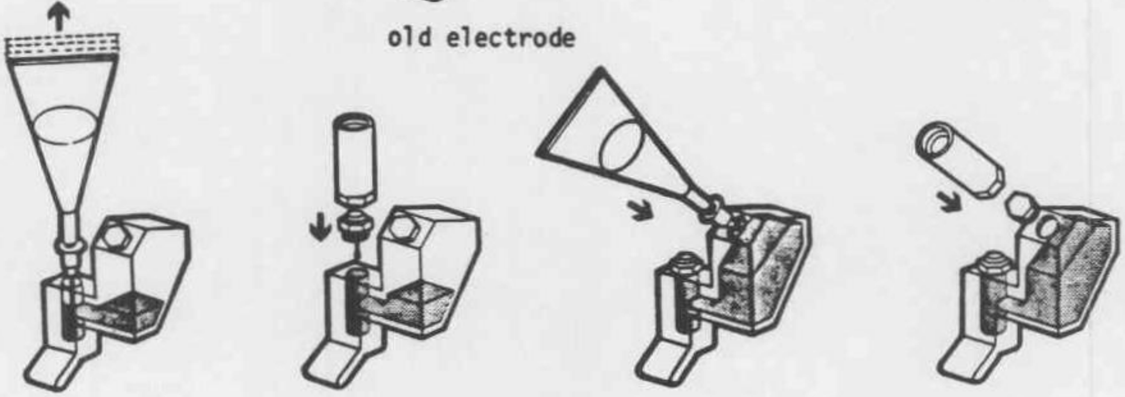
Disinfect and stop the 614 system.







old electrode



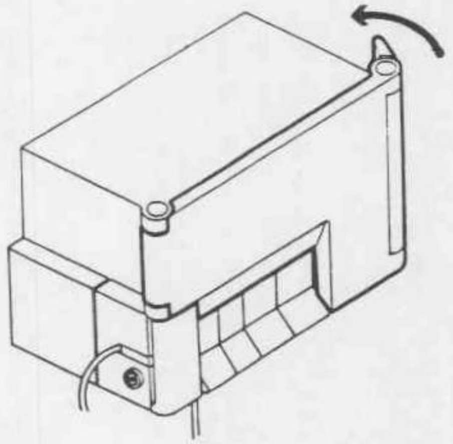
new electrode cassette

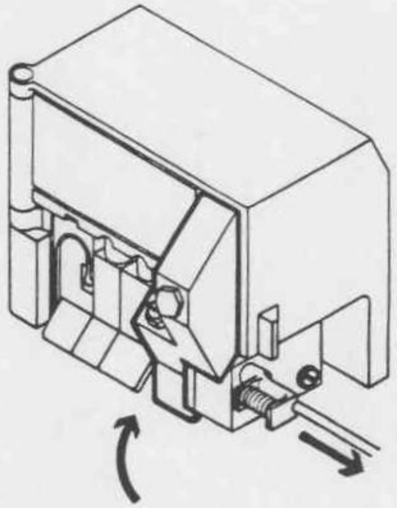
Use the hex tool supplied to unscrew and tighten the reference electrode inner and reservoir sealing plug. Remove the electrode plug and the reservoir sealing plug. Break the top off the reference electrode fill solution container, and fit the needle.

5.12 To Replace the Reference Electrode Cassette (cont)

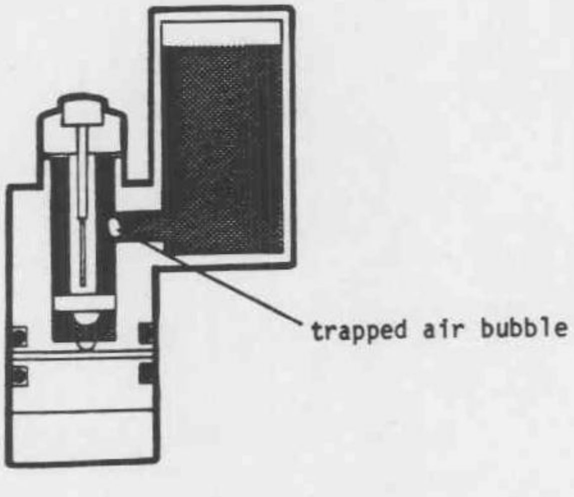
CAUTION: Do not use Na$^+$/K$^+$/Ca^{++} or pH electrode fill solution.

Slowly inject solution into the reference electrode fill hole, avoid trapping air bubbles. Tap the electrode during filling to dislodge air bubbles. Continue filling until a bubble of solution appears at the electrode fill hole - the level of solution in the electrode cassette will decrease until the KCl crystals are wet. Remove the electrode inner from the old cassette and screw into the electrode fill hole. Continue to inject the remaining fill solution into the reservoir, but be careful not to overfill. Replace the plug. Shake the electrode down, like a thermometer, to dislodge air bubbles at the electrode tip. Make sure the vent hole is not blocked. Carefully clean off any excess fill solution using dry tissue and, if necessary, fit an '0' ring to each side of the electrode.





NOTE: Following a change of reference electrode it is normal for the 614 to require a stabilization period of 30 minutes before optimum performance is obtained. If an OVER RANGE or UNDER RANGE reading is displayed on both channels, there is probably an air bubble trapped in the reference electrode. Remove the electrode and tap it until the air bubble has been dislodged. Re-install the electrode.

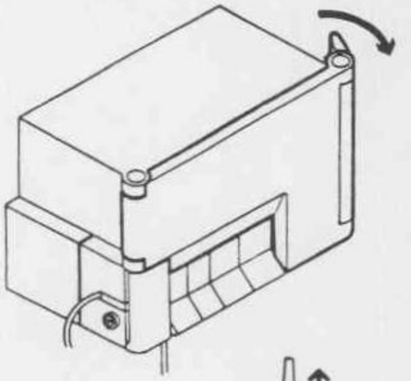


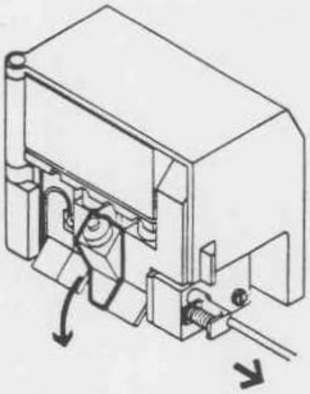
5.13 To Fill the Na^+ and K^+ Electrodes

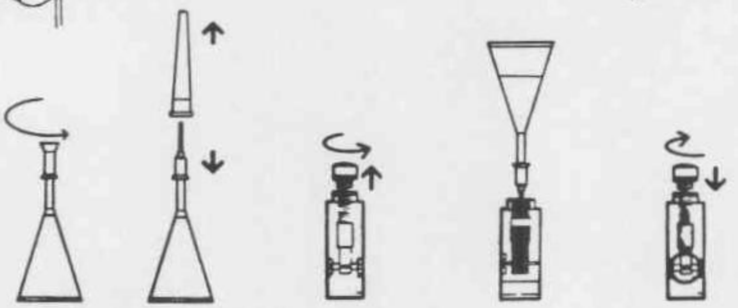
Equipment

Disinfectant; $Na^+/K^+/Ca^{++}$ electrode fill solution, Cat. 478535.

Disinfect and stop the 614 system.

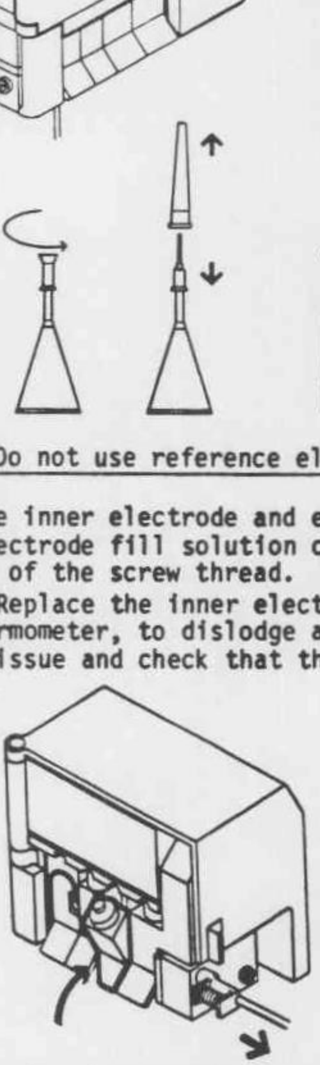


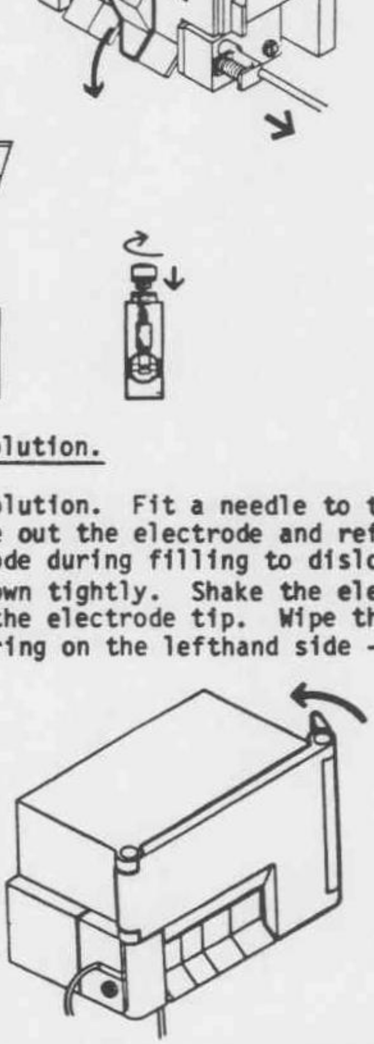




CAUTION: Do not use reference electrode fill solution.

Unscrew the inner electrode and empty out the solution. Fit a needle to the $Na^+/K^+/Ca^{++}$ electrode fill solution container, rinse out the electrode and refill to the bottom of the screw thread. Tap the electrode during filling to dislodge air bubbles. Replace the inner electrode - screw down tightly. Shake the electrode down like a thermometer, to dislodge air bubbles at the electrode tip. Wipe the electrode with dry tissue and check that there is an 'O' ring on the lefthand side - fit one if necessary.



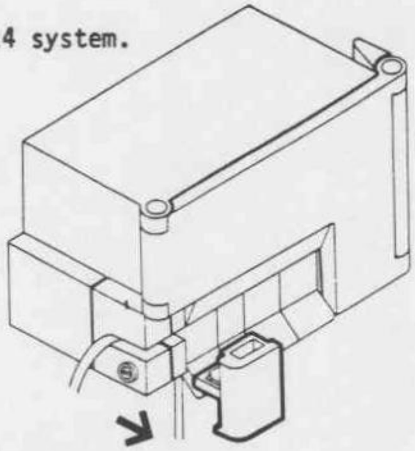


NOTE: Ciba Corning recommend that a deproteinizing and conditioning routine (Section 5.4) is carried out after this procedure. If a new K^+ electrode has been installed, it may require a stabilization time of up to 90 minutes before optimum performance is obtained.

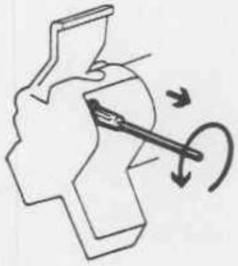
5.14 To Replace the Probe, Probe Tubing and Waste Tube

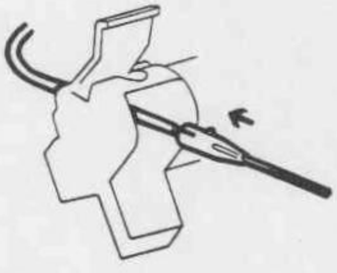
Equipment
Disinfectant; Probe and tubing kit, Cat. 478634

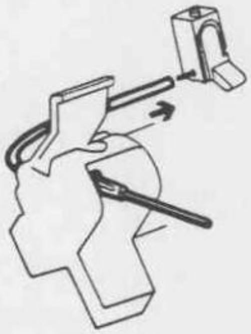
Disinfect and stop the 614 system.

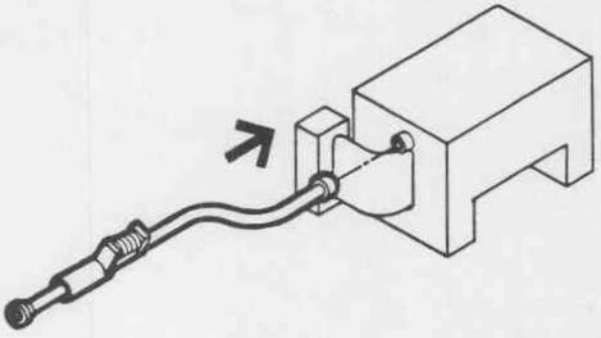


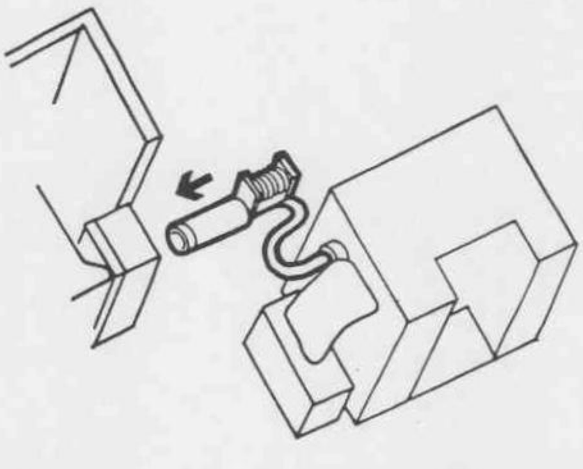
Remove the sample detector cover.









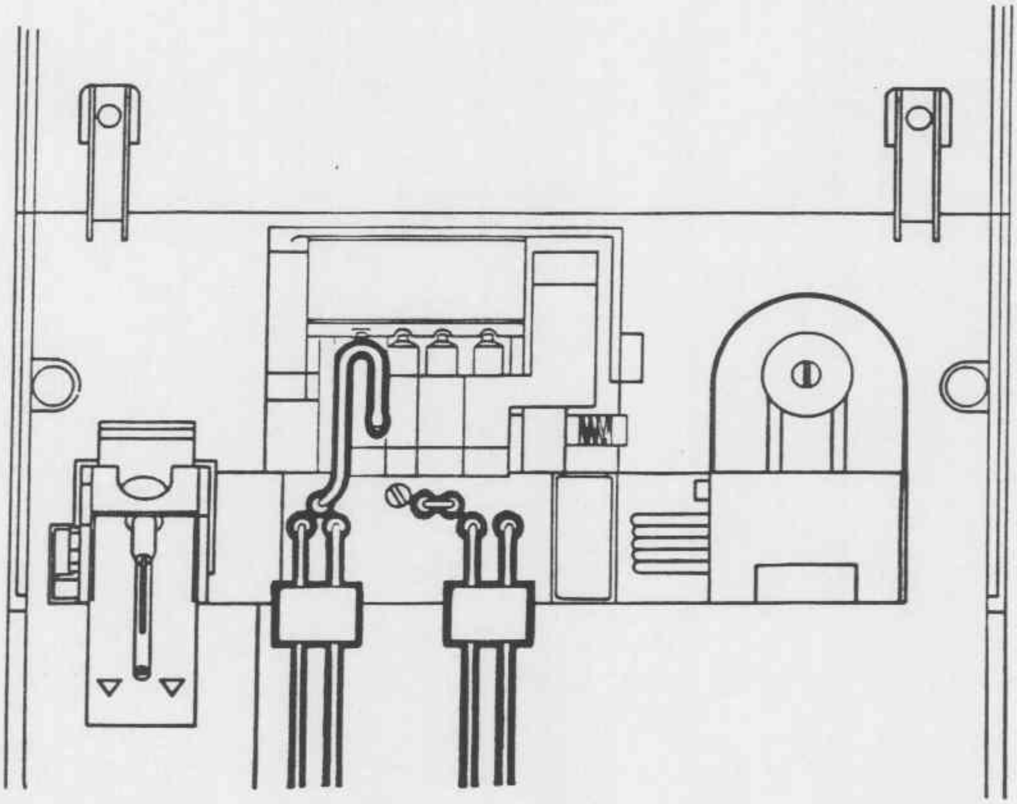


Replace the sample detector cover.

5.15 To Replace the Connecting Tubing

Equipment
Connecting tubing kit, Cat. 478653.

Drain the 614.



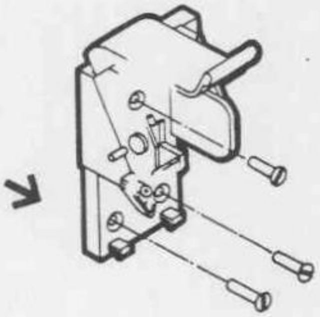
5.16 To Replace the Probe Micro Switch

Equipment
Disinfectant; Screwdriver, supplied with Installation Pack; Micro switch, Cat. 478623.

Disinfect and stop the 614 system.

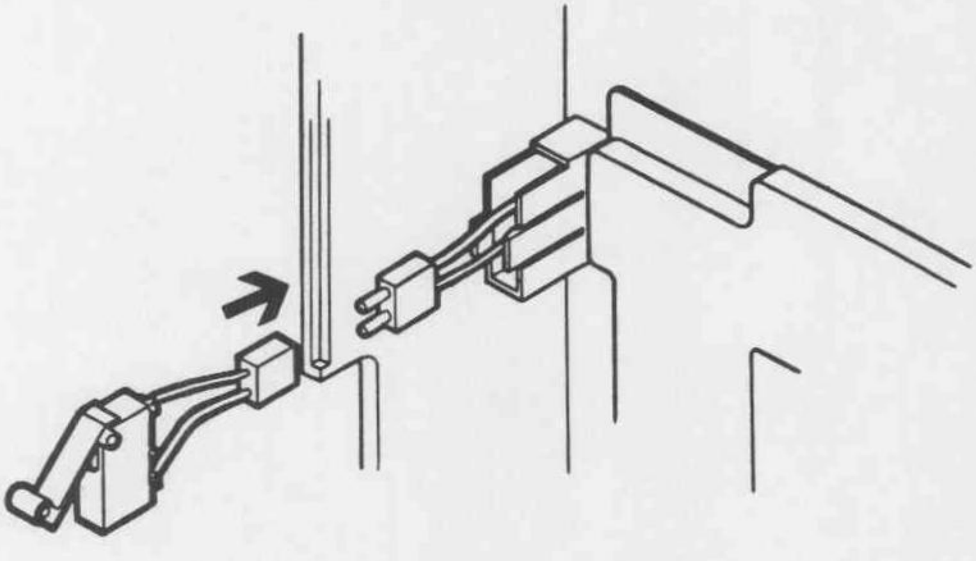
Remove the weir cover, Section 5.8.

Remove the probe and tubing, Section 5.14.



Remove the probe assembly.

If necessary, remove the transit strap from the micro switch connector.



If desired, refit the transit strap.

Replace the probe assembly, probe and tubing and weir cover. Check that the micro switch is operating, Section 6.4, paragraph 5.

5.17 To Replace the Manifold and Solenoids

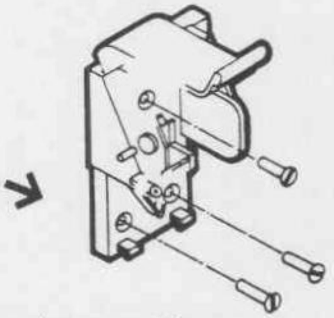
Equipment
Disinfectant; Manifold, Cat. 478841; Solenoid assembly, Cat. 478842; or Manifold and solenoid kit, Cat. 478823; Manifold plug, Cat. 478825; Manifold gasket, Cat. 478824; as required; Screwdriver, supplied with Installation Pack.

Disinfect and drain the 614.

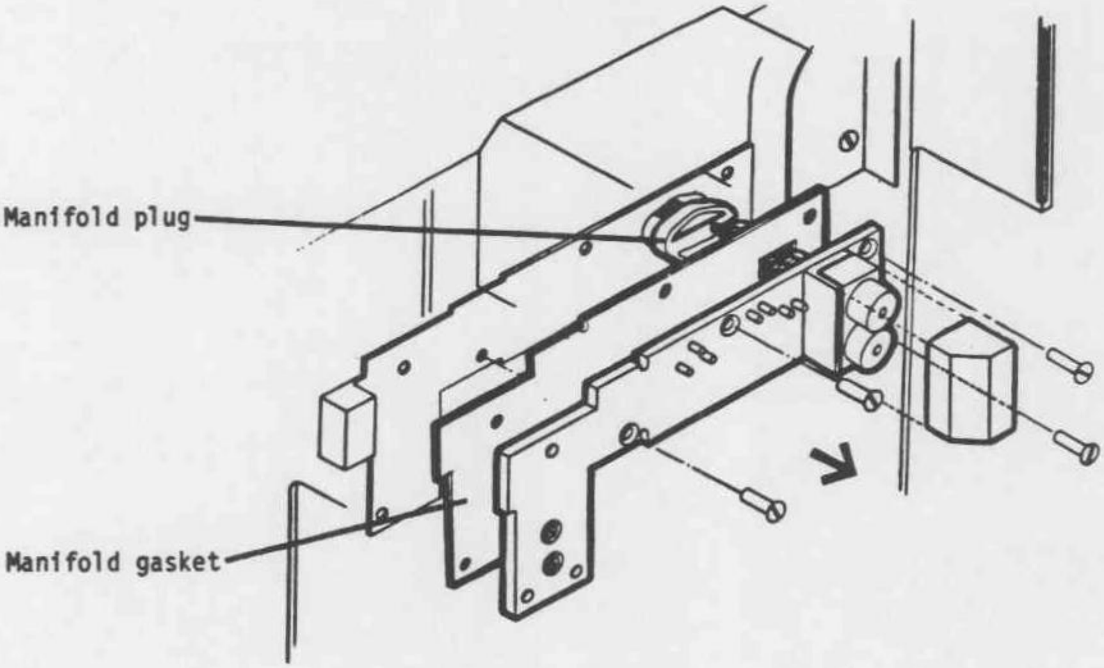
Remove the weir cover, Section 5.8.

Remove the probe and probe tubing, Section 5.14.

Remove the pump tube cassette, Section 5.11.

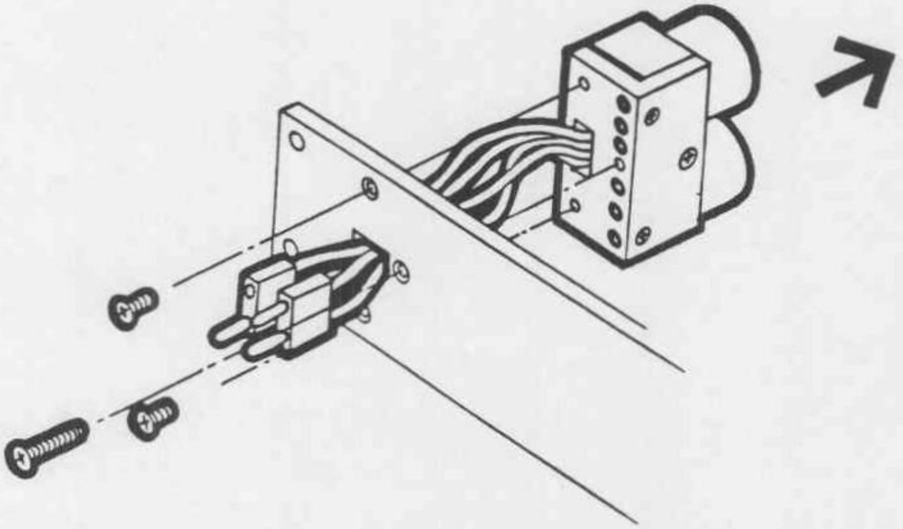


Remove the probe assembly.



Disconnect all tubing from the manifold, and remove the manifold. Remove the manifold plug. If necessary, remove the transit straps from the solenoid connectors, and disconnect.

5.17 To Replace the Manifold and Solenoids (cont)



Remove the solenoid assembly, take care not to lose the '0' rings.

Using new parts as required:

Replace the solenoid assembly on the manifold. Make sure the '0' rings are still fitted.

Feed the connectors through the manifold gasket and reconnect. If desired, refit the transit straps.

Slide the solenoid leads into the manifold plug, and replace the plug.

Replace the manifold.

Replace all tubing, (Section 5.15).

Replace the pump tube cassette.

Replace the solenoid cover.

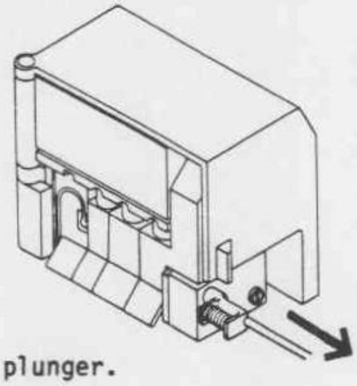
Replace the probe assembly, probe, probe tubing and weir cover. Check that the micro switch is operating, Section 6.4, paragraph 5.

5.18 To Replace the Sample Detectors

Equipment
Disinfectant; Screwdriver, flat blade, small; Sample detector (inlet), Cat. 478673; Sample detector (outlet), Cat. 478674.

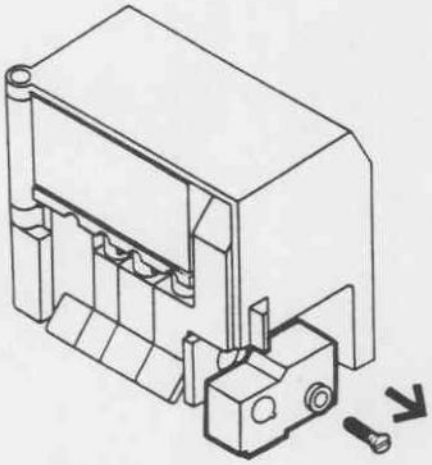
Disinfect and stop the 614 system.

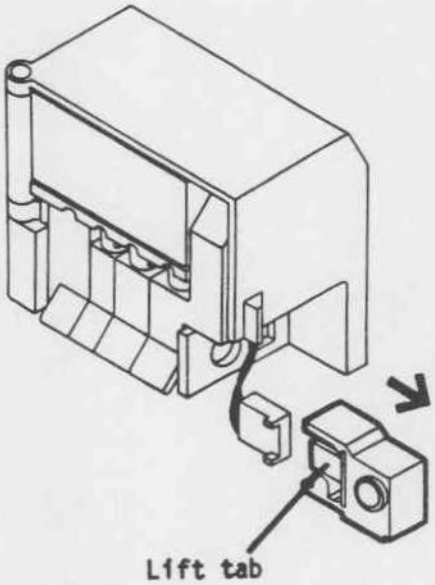
Remove the probe and tubing, Section 5.14.



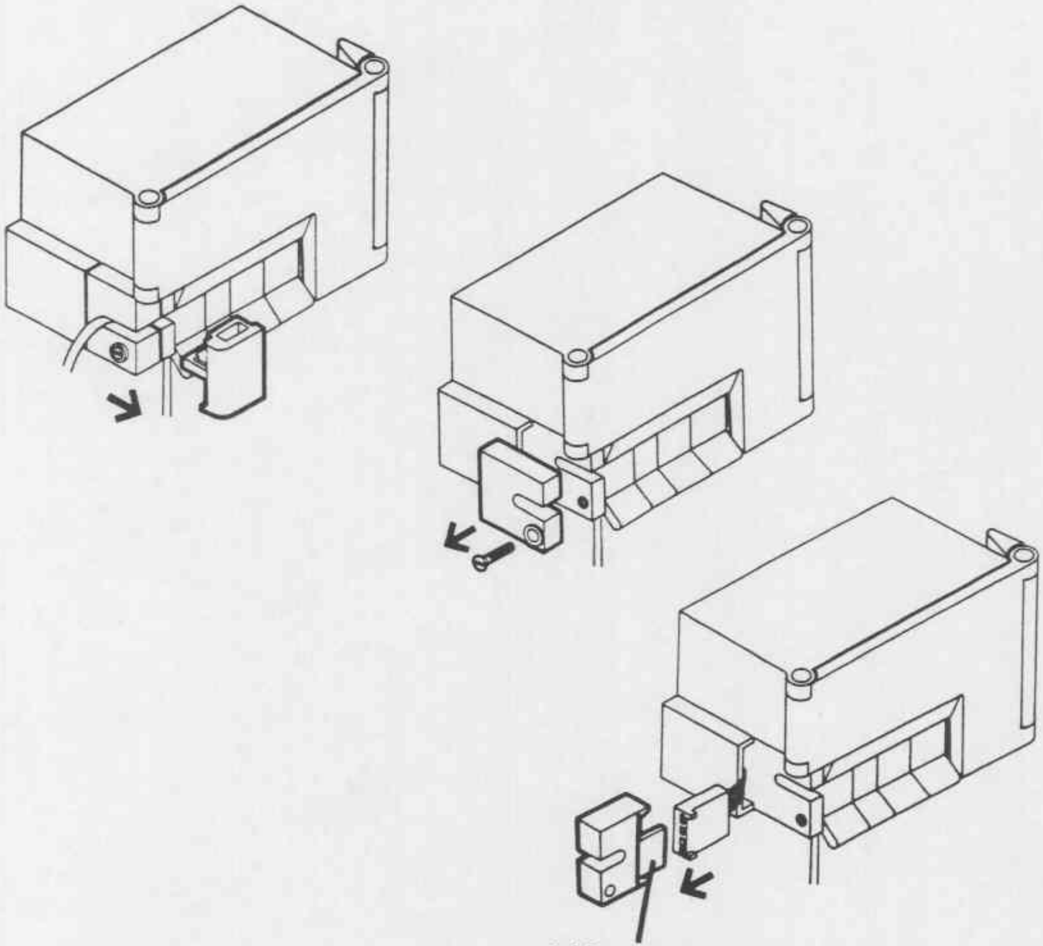
Remove the waste tube and plunger.

Remove the pump tube cassette, Section 5.11.





5.18 To Replace the Sample Detectors (cont)

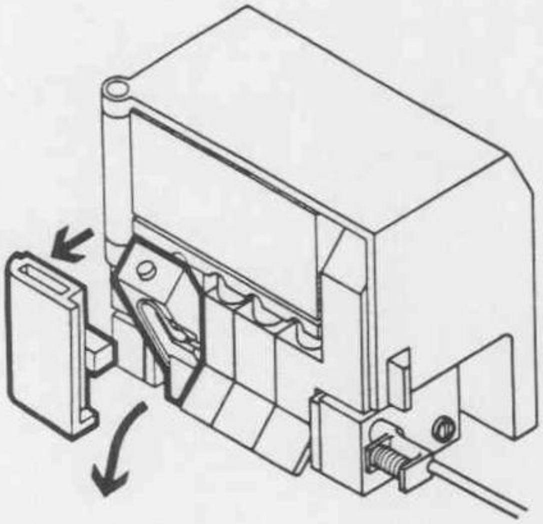


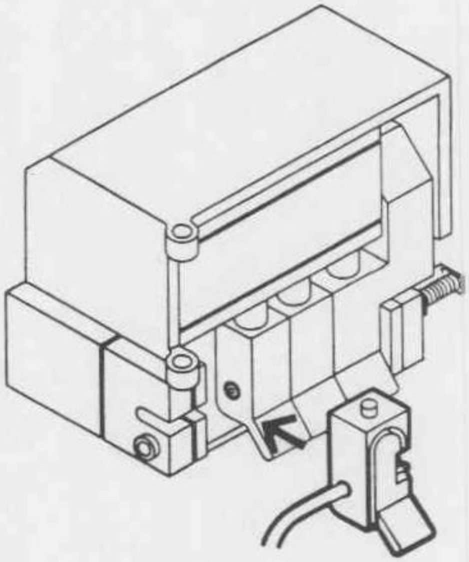
Reassemble in reverse order.

5.19 To Replace the Slope Inlet Block

Equipment
Disinfectant; Slope inlet block, Cat. 478542.

Disinfect and stop the 614 system.



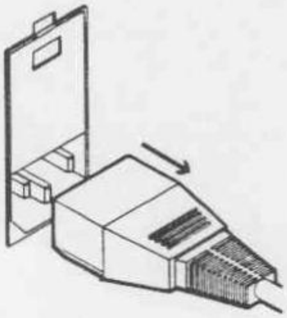


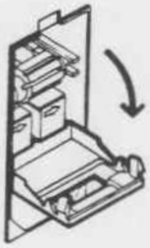
Remove the probe tubing and slope tube from the slope inlet block and fit to the new block.

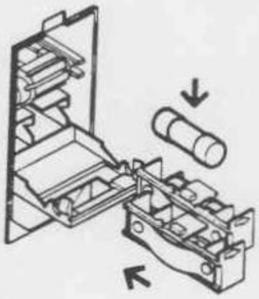
5.20 To Replace a Fuse

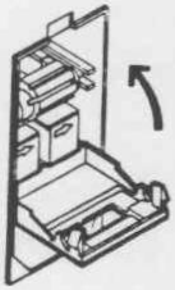
Equipment
Fuses, Cat. 478648.

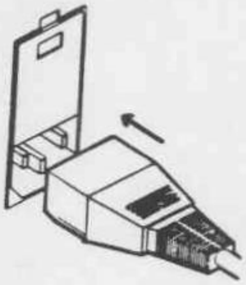
WARNING: For continued protection against fire hazard use only the same type and rating of fuse that was fitted originally to the 614 - refer to instrument rear panel.











Make sure that the voltage selector bobbin is set to the correct voltage for the local power supply.

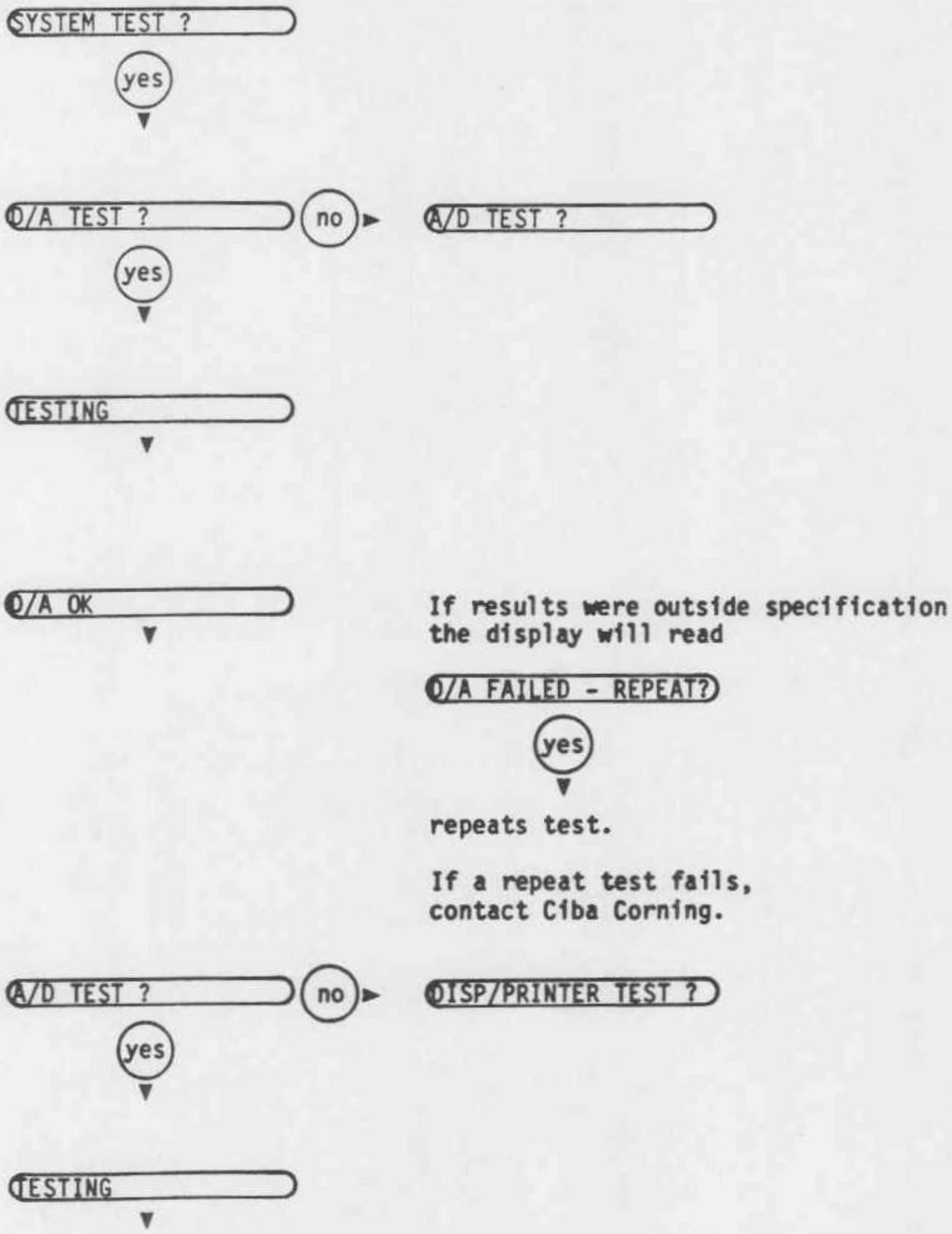
Voltage Selected	Voltage Range
100V	85V to 110V
120V	102V to 132V
220V	187V to 242V
240V	204V to 264V

CAUTION: Do not rotate the voltage selector bobbin when it is fitted in the voltage selector as this will damage the contacts.

5.21 System Test Routine

This routine allows the user to check the instrument functions. The following test routines are available: D/A converter, A/D converter, display and printer, and electrode outputs. If the integral printer is enabled the date, time and result of each test will be printed.

NOTE: The electrode output routine will not be accessible if SYSTEM TEST ? is entered from ANALYZE URINE ? .


SYSTEM TEST ?
yes
D/A TEST ?
no
A/D TEST ?
yes
TESTING
D/A OK
D/A FAILED - REPEAT?
yes
A/D TEST ?
no
DISP/PRINTER TEST ?
yes
TESTING

If results were outside specification the display will read

repeats test.

If a repeat test fails, contact Ciba Corning.

5.21 System Test Routine (cont)

▼

A/D OK

▼

If results were outside specification the display will read

A/D FAILED - REPEAT?

yes

▼

repeats test.

If a repeat test fails, contact Ciba Corning.

▼

DISP/PRINTER TEST ? no ► ELECTRODE O/P TEST ?

yes

▼

HHHHHHHHHHHHHHHHHHHH

yes or no (or 10 seconds)

▼

IIIIIIIIIIIIIIIIIIII

yes or no (or 10 seconds)

▼

####################

yes or no (or 10 seconds)

▼

ELECTRODE O/P TEST ? no ► ANALYZE BLOOD ?

NOTE: If SYSTEM TEST ? was entered from ANALYZE URINE ? mode the electrode output test routine will not be available.

yes

▼

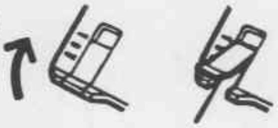
mV MODE ? yes ►

► Select the mV mode to check electrode mV output. The mmol/L mode can be used to visually monitor electrode signal output.

no

▼

mmol/L MODE ? yes ► OPEN PROBE



▼

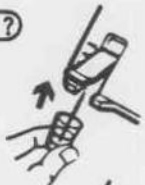
5.21 System Test Routine (cont)

▼

PROBE IN TEST SOLN ?

yes

▼

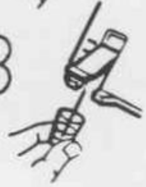


NOTE: TEST SOLN in mV mode should be Cal/Flush or slope solution for comparison with mV values given.

SAMPLING

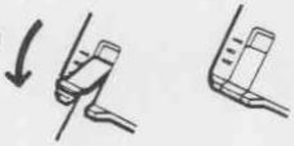
SAMPLING - WAIT

▼



RETURN PROBE

▼



(If the probe is not returned within 10 seconds the tone will sound).

MEASURING

PLEASE WAIT

▼

Na=XXX.X K=XXX.X mV

or

Na=XXX K=X.XX mmol/L

▼

The results are displayed and will change as the electrode outputs plateau. After 30 seconds the display is frozen. If in mV mode check that the readings are within:

	Minimum mV	Maximum mV
Cal/Flush	35	100

Slope Na should be between 4.7 and 8.8 mV less than the measured Cal/Flush mV level.

Slope K should be between 13.5 and 19.6 mV more than the measured Cal/Flush mV level.

If the results are outside these ranges, refill the Na^+ and K^+ electrodes, Section 5.13.

▼

ELECTRODE O/P TEST ? yes ► repeats test.

no

▼

ANALYZE BLOOD ?

6 Troubleshooting

6.1 General

(a) The 614 continually performs a self-diagnostic test to maintain integrity of results. If at any time the instrument detects an abnormality it will inform the user by displaying CHECK SET-UP alternating with either ANALYZE BLOOD ?, ANALYZE URINE ?, STANDARDIZE ?, LAST RESULT RECALL ?, AUTOSAMPLER ? or a standardization error message. The Check/Service menu is not accessible until yes is pressed to RETURN TO SET-UP ?

Measurements can still be made, but all information relating to the result will be based on standard (default) values, as follows:

Date and time not entered
Na^+ and K^+ selected
Correlation values - Na^+ slope = 1.02, Na^+ intercept = 0
- K^+ slope = 0.96, K^+ intercept = 0.15
Reference ranges not set
QC prompts not set
QC limits not set
Automatic standardization mode selected
Printer off
Security off

User-entered Set-Up parameters can be re-entered when convenient as normal - see Section 2.

(b) The Troubleshooting Charts are intended to help users clear faults as quickly as possible. The chart index will lead you to the correct chart, or alternatively, Section 6.3, Error Messages, gives the appropriate chart number for a specific message.

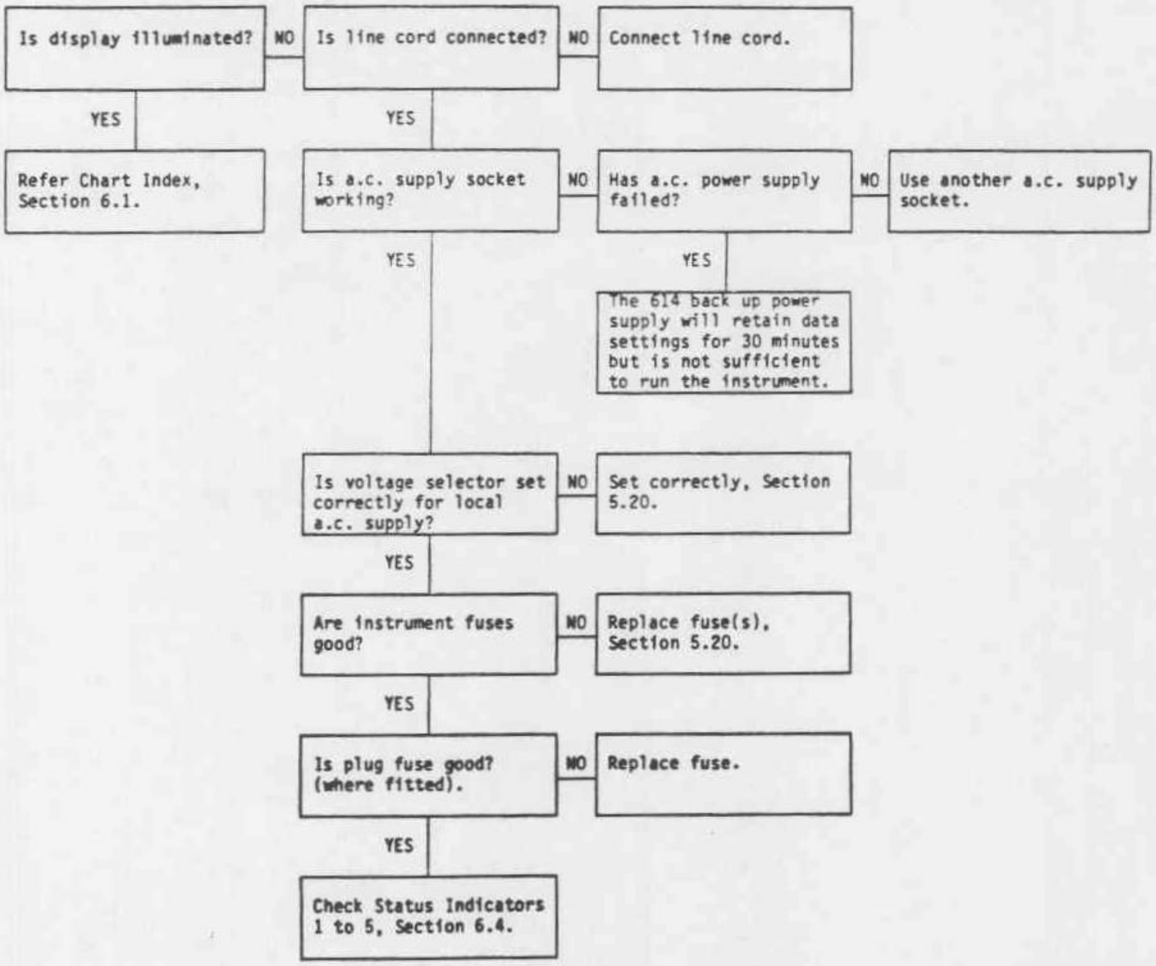
The charts are arranged as a series of questions with only two possible answers, YES or NO. If the answer is YES you move down the chart to the next question. If the answer is NO, you move across the chart, to the next question. References are given to other sections of this manual for detailed information.

Chart No.	Fault
1	Display not illuminated
2	Sample or QC reading underrange/overrange
3	Cal or slope failed
4	Reading unstable/drifting
5	Sampling problems (cal/flush or slope)
6	Sampling problems (samples, QC or urine slope)
7	Printout problems

NOTE: If the 614 does not respond to any user input, refer to Section 6.4 and check Status Indicator 5, microprocessor.

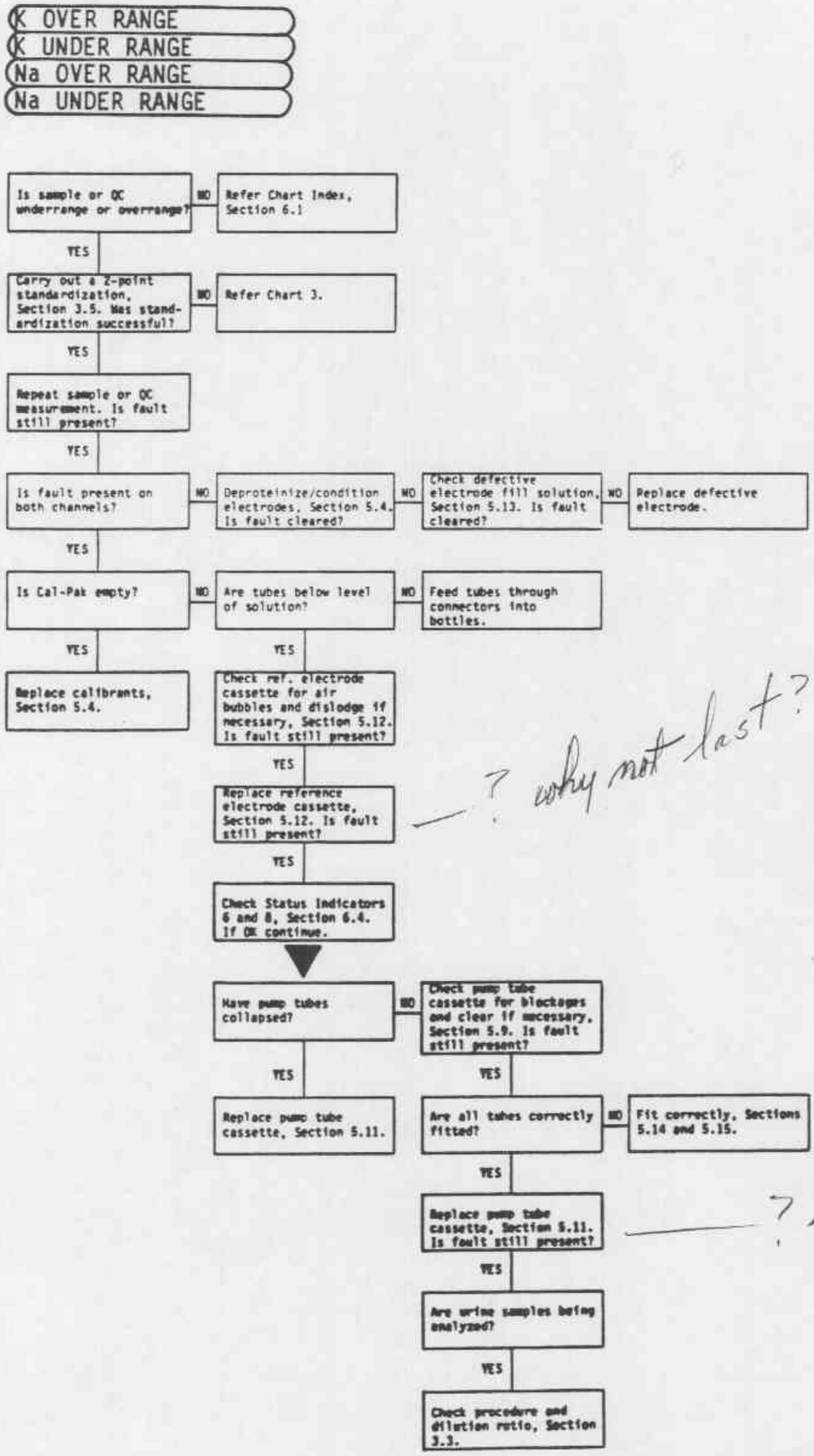
6.2 Troubleshooting Charts

Chart 1 Display Not Illuminated


Is display illuminated?
NO
Is line cord connected?
NO
Connect line cord.
YES
YES
Refer Chart Index, Section 6.1.
Is a.c. supply socket working?
NO
Has a.c. power supply failed?
NO
Use another a.c. supply socket.
YES
YES
The 614 back up power supply will retain data settings for 30 minutes but is not sufficient to run the instrument.
Is voltage selector set correctly for local a.c. supply?
NO
Set correctly, Section 5.20.
YES
Are instrument fuses good?
NO
Replace fuse(s), Section 5.20.
YES
Is plug fuse good? (where fitted).
NO
Replace fuse.
YES
Check Status Indicators 1 to 5, Section 6.4.

IF FAULT PERSISTS
CONTACT CIBA CORNING OR
DISTRIBUTOR

6.2 Chart 2 Sample or QC Reading Underrange/Overrange

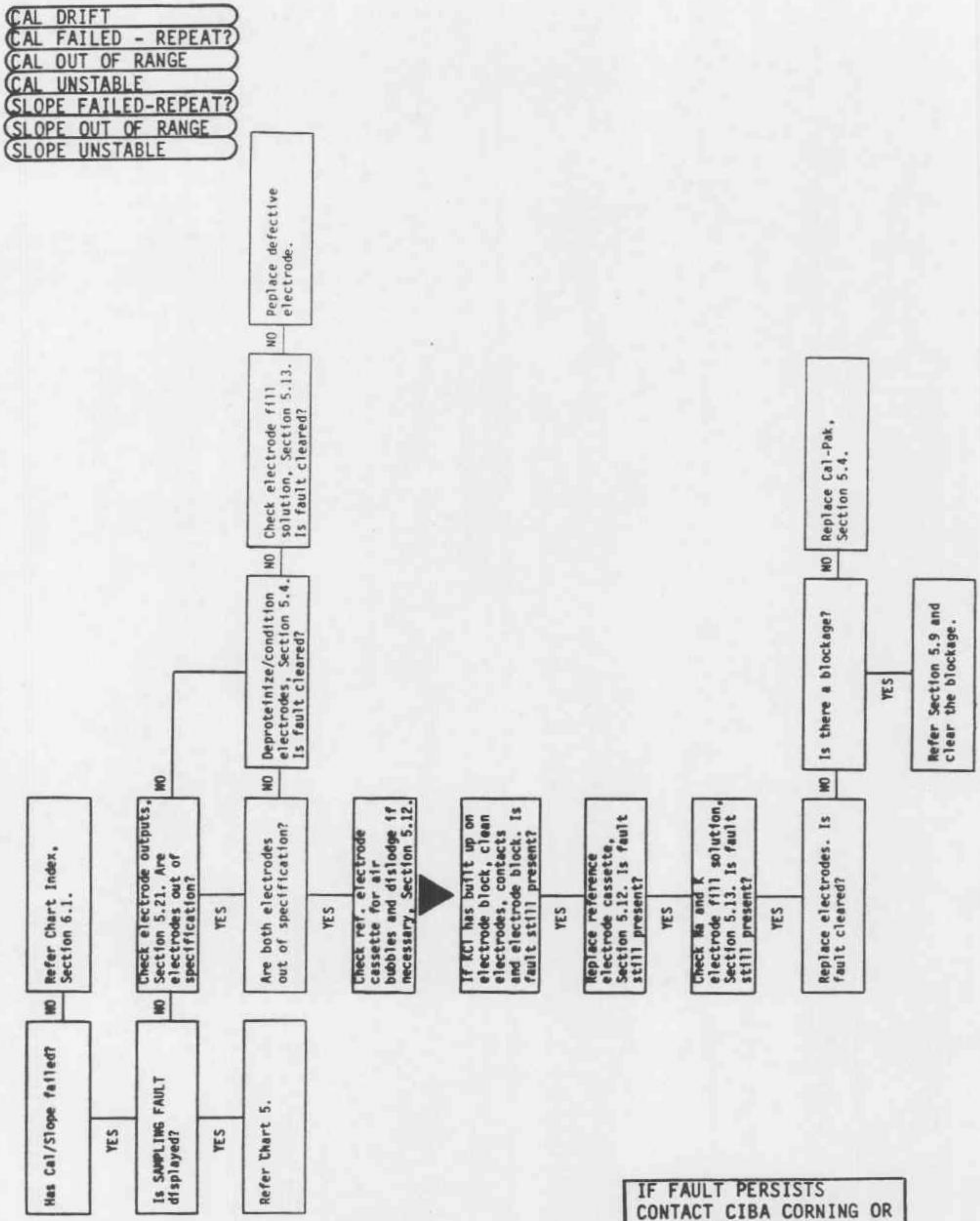

K OVER RANGE
K UNDER RANGE
Na OVER RANGE
Na UNDER RANGE
Is sample or QC underrange or overrange?
NO
Refer Chart Index, Section 6.1
YES
Carry out a 2-point standardization, Section 3.5. Was standardization successful?
NO
Refer Chart 3.
YES
Repeat sample or QC measurement. Is fault still present?
YES
Is fault present on both channels?
NO
Deproteinize/condition electrodes, Section 5.4. Is fault cleared?
NO
Check defective electrode fill solution, Section 5.13. Is fault cleared?
NO
Replace defective electrode.
YES
Is Cal-Pak empty?
NO
Are tubes below level of solution?
NO
Feed tubes through connectors into bottles.
YES
Replace calibrants, Section 5.4.
YES
Check ref. electrode cassette for air bubbles and dislodge if necessary, Section 5.12. Is fault still present?
YES
Replace reference electrode cassette, Section 5.12. Is fault still present?
YES
Check Status Indicators 6 and 8, Section 6.4. If OK continue.
Have pump tubes collapsed?
NO
Check pump tube cassette for blockages and clear if necessary, Section 5.9. Is fault still present?
YES
Replace pump tube cassette, Section 5.11.
YES
Are all tubes correctly fitted?
NO
Fit correctly, Sections 5.14 and 5.15.
YES
Replace pump tube cassette, Section 5.11. Is fault still present?
YES
Are urine samples being analyzed?
YES
Check procedure and dilution ratio, Section 3.3.

? why not last?

? last

IF FAULT PERSISTS
CONTACT CIBA CORNING OR
DISTRIBUTOR

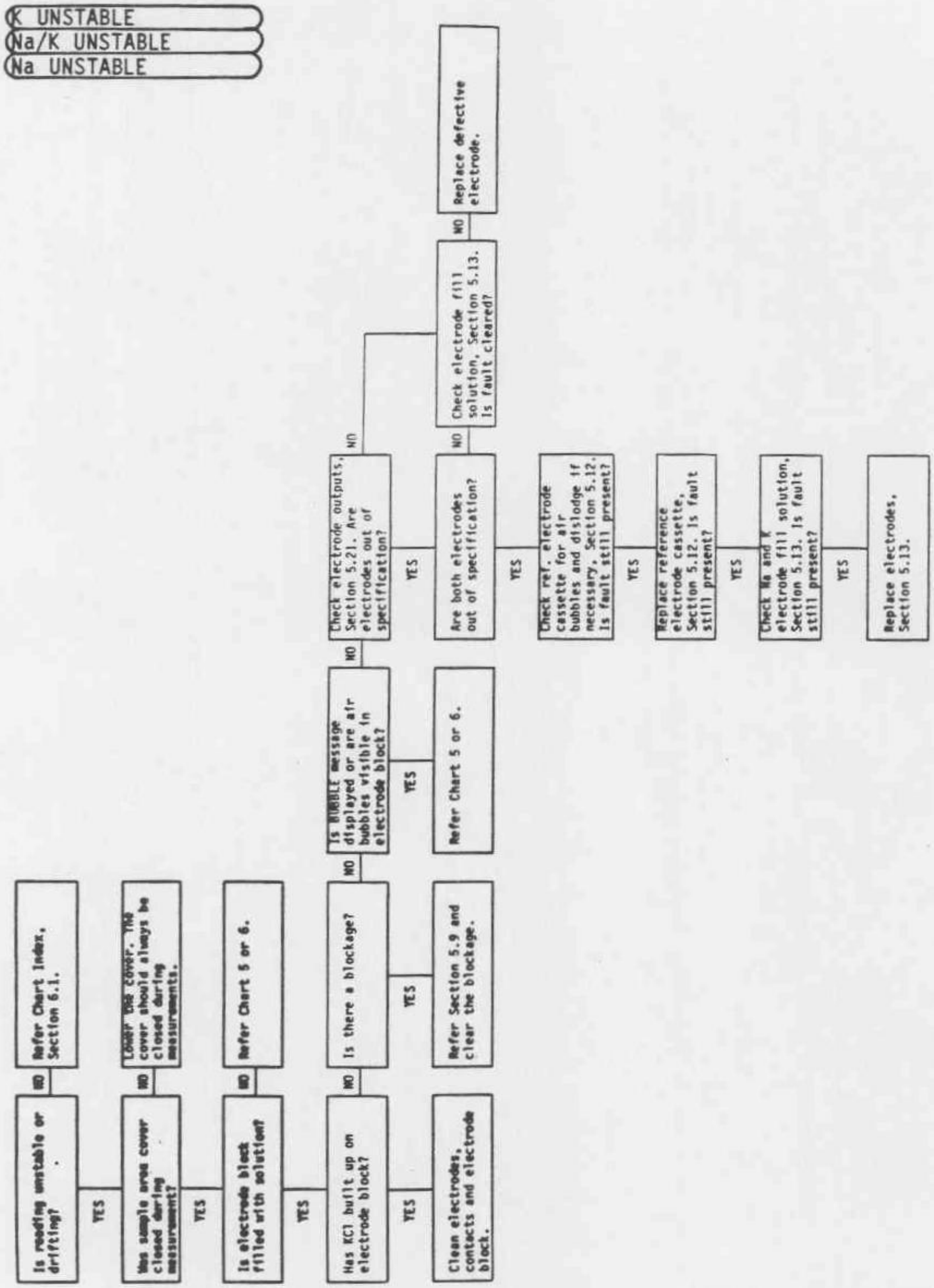
6.2 Chart 3 Cal or Slope Failed


CAL DRIFT
CAL FAILED - REPEAT?
CAL OUT OF RANGE
CAL UNSTABLE
SLOPE FAILED-REPEAT?
SLOPE OUT OF RANGE
SLOPE UNSTABLE
Has Cal/Slope failed?
NO
Refer Chart Index, Section 6.1.
YES
Is SAMPLING FAULT displayed?
NO
Check electrode outputs, Section 5.21. Are electrodes out of specification?
NO
YES
Refer Chart 5.
YES
Are both electrodes out of specification?
NO
Deproteinize/condition electrodes, Section 5.4. Is fault cleared?
NO
Check electrode fill solution, Section 5.13. Is fault cleared?
NO
Peplace defective electrode.
YES
Check ref. electrode cassette for air bubbles and dislodge if necessary, Section 5.12.
If KCl has built up on electrode block, clean electrodes, contacts and electrode block. Is fault still present?
YES
Replace reference electrode cassette, Section 5.12. Is fault still present?
YES
Check Na and K electrode fill solution, Section 5.13. Is fault still present?
YES
Replace electrodes. Is fault cleared?
NO
Is there a blockage?
NO
Replace Cal-Pak, Section 5.4.
YES
Refer Section 5.9 and clear the blockage.

IF FAULT PERSISTS
CONTACT CIBA CORNING OR
DISTRIBUTOR

6.2 Chart 4 Reading Unstable/Drifted

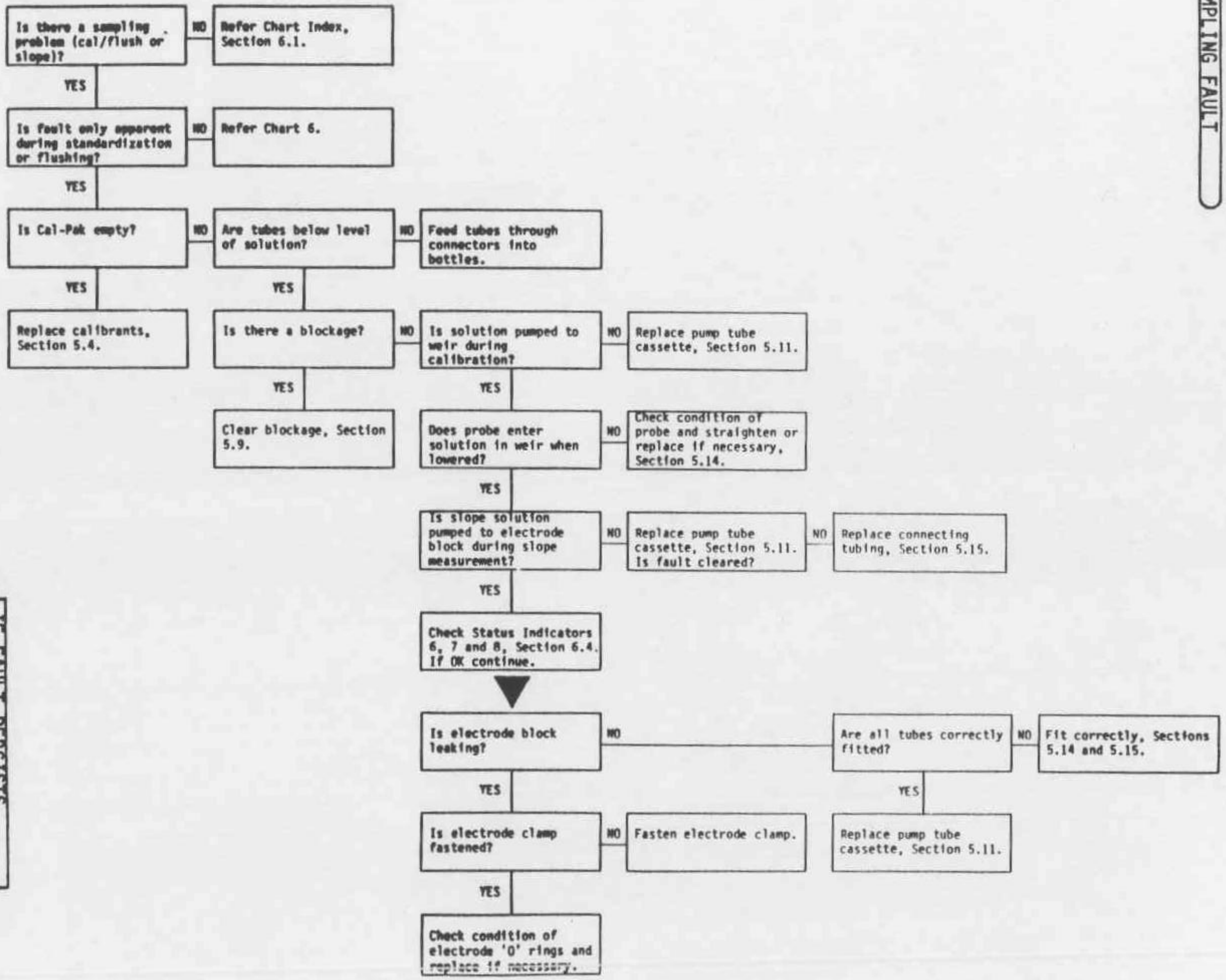
K UNSTABLE
Na/K UNSTABLE
Na UNSTABLE


Is reading unstable or drifting?
NO
Refer Chart Index, Section 6.1.
YES
Was sample area cover closed during measurement?
NO
LOWER THE COVER. The cover should always be closed during measurements.
YES
Is electrode block filled with solution?
NO
Refer Chart 5 or 6.
YES
Has KCl built up on electrode block?
YES
Clean electrodes, contacts and electrode block.
NO
Is there a blockage?
YES
Refer Section 5.9 and clear the blockage.
NO
Is BUBBLE message displayed or are air bubbles visible in electrode block?
YES
Refer Chart 5 or 6.
NO
Check electrode outputs, Section 5.21. Are electrodes out of specification?
NO
Check electrode fill solution, Section 5.13. Is fault cleared?
NO
Replace defective electrode.
YES
Are both electrodes out of specification?
NO
YES
Check ref. electrode cassette for air bubbles and dislodge if necessary, Section 5.12. Is fault still present?
YES
Replace reference electrode cassette, Section 5.12. Is fault still present?
YES
Check Na and K electrode fill solution, Section 5.13. Is fault still present?
YES
Replace electrodes, Section 5.13.

IF FAULT PERSISTS
CONTACT CIBA CORNING OR
DISTRIBUTOR

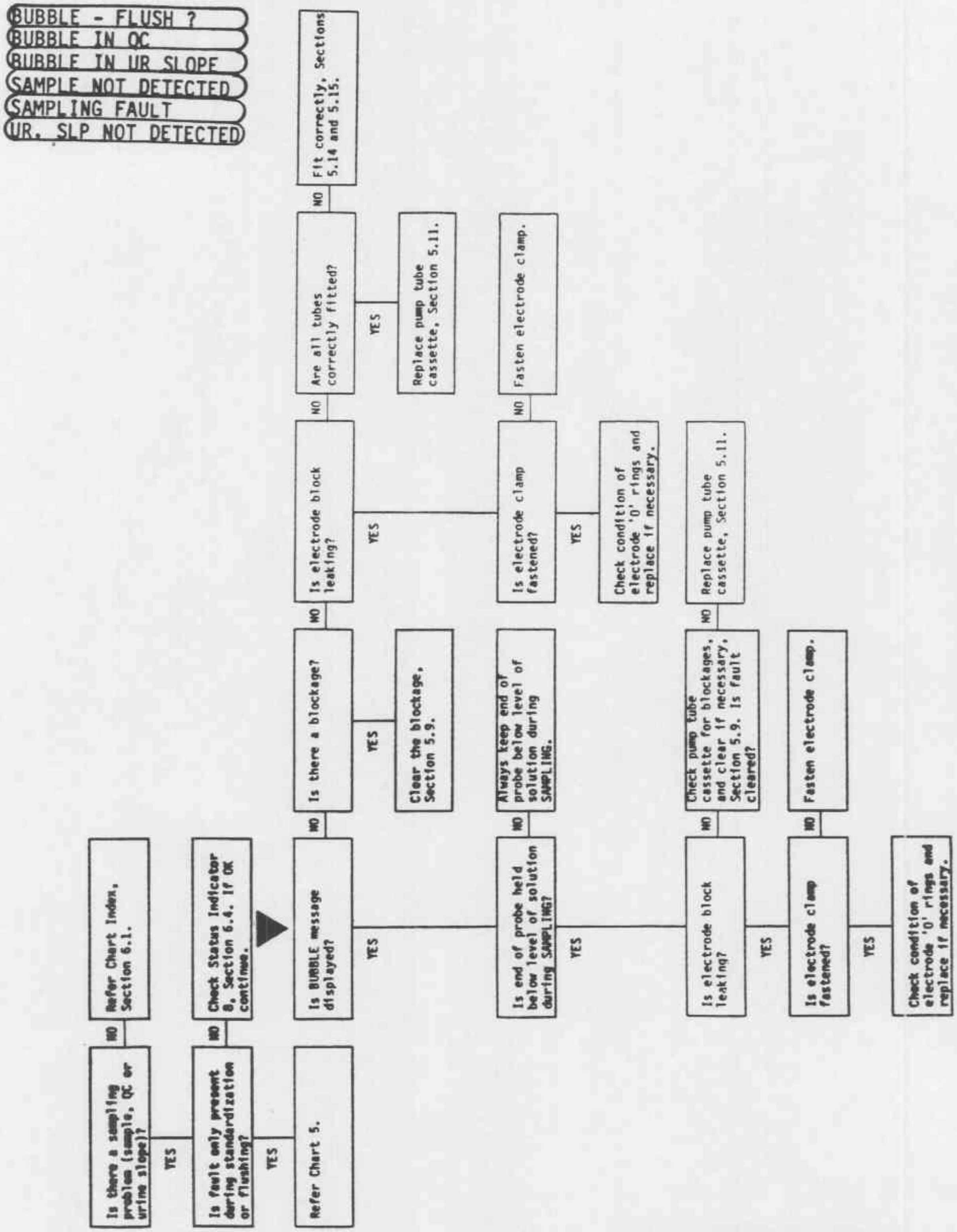
6.2 Chart 5 Sampling Problems (Cal/Flush or Slope)

SAMPLING FAULT


Is there a sampling problem (cal/flush or slope)?
NO
Refer Chart Index, Section 6.1.
YES
Is fault only apparent during standardization or flushing?
NO
Refer Chart 6.
YES
Is Cal-Pak empty?
NO
Are tubes below level of solution?
NO
Feed tubes through connectors into bottles.
YES
Replace calibrants, Section 5.4.
YES
Is there a blockage?
YES
Clear blockage, Section 5.9.
NO
Is solution pumped to weir during calibration?
NO
Replace pump tube cassette, Section 5.11.
YES
Does probe enter solution in weir when lowered?
NO
Check condition of probe and straighten or replace if necessary, Section 5.14.
YES
Is slope solution pumped to electrode block during slope measurement?
NO
Replace pump tube cassette, Section 5.11. Is fault cleared?
NO
Replace connecting tubing, Section 5.15.
YES
Check Status Indicators 6, 7 and 8, Section 6.4. If OK continue.
Is electrode block leaking?
NO
Are all tubes correctly fitted?
NO
Fit correctly, Sections 5.14 and 5.15.
YES
Replace pump tube cassette, Section 5.11.
YES
Is electrode clamp fastened?
NO
Fasten electrode clamp.
YES
Check condition of electrode 'O' rings and replace if necessary.

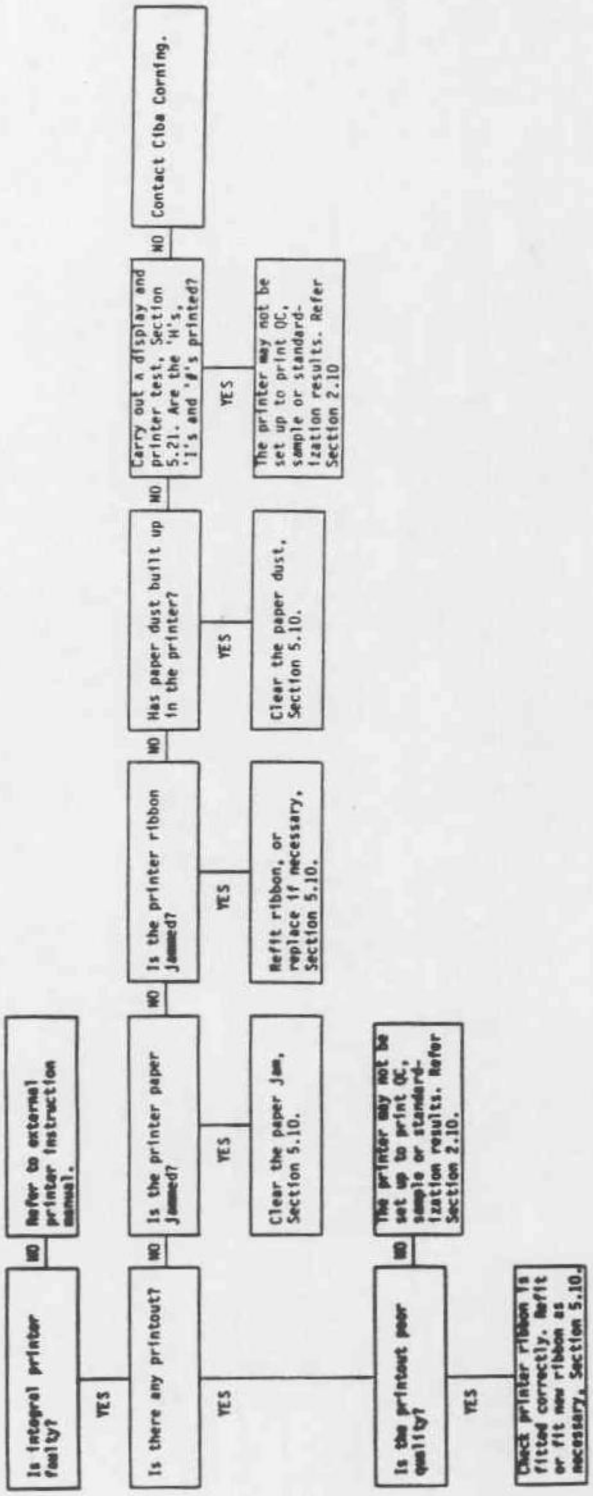
IF FAULT PERSISTS
CONTACT CIBA CORNING OR
DISTRIBUTOR

6.2 Chart 6 Sampling Problems (Samples, QC or Urine Slope)


BUBBLE - FLUSH ?
BUBBLE IN QC
BUBBLE IN UR SLOPE
SAMPLE NOT DETECTED
SAMPLING FAULT
UR. SLP NOT DETECTED
Is there a sampling problem (sample, QC or urine slope)?
NO
Refer Chart Index, Section 6.1.
YES
Is fault only present during standardization or flushing?
NO
Check Status Indicator 8, Section 6.4. If OK continue.
YES
Refer Chart 5.
Is BUBBLE message displayed?
NO
Is there a blockage?
YES
Clear the blockage, Section 5.9.
NO
Is electrode block leaking?
NO
Are all tubes correctly fitted?
NO
Fit correctly, Sections 5.14 and 5.15.
YES
Replace pump tube cassette, Section 5.11.
YES
Is electrode clamp fastened?
NO
Fasten electrode clamp.
YES
Check condition of electrode 'O' rings and replace if necessary.
YES
Is end of probe held below level of solution during SAMPLING?
NO
Always keep end of probe below level of solution during SAMPLING.
YES
Is electrode block leaking?
NO
Check pump tube cassette for blockages, and clear if necessary, Section 5.9. Is fault cleared?
NO
Replace pump tube cassette, Section 5.11.
YES
Is electrode clamp fastened?
NO
Fasten electrode clamp.
YES
Check condition of electrode 'O' rings and replace if necessary.

IF FAULT PERSISTS
CONTACT CIBA CORNING OR
DISTRIBUTOR

6.2 Chart 7 Printout Problems


Is integral printer faulty?
NO
Refer to external printer instruction manual.
YES
Is there any printout?
NO
Is the printer paper jammed?
YES
Clear the paper jam, Section 5.10.
NO
Is the printer ribbon jammed?
YES
Refit ribbon, or replace if necessary, Section 5.10.
NO
Has paper dust built up in the printer?
YES
Clear the paper dust, Section 5.10.
NO
Carry out a display and printer test, Section 5.21. Are the 'H's, 'I's and '#'s printed?
YES
The printer may not be set up to print QC, sample or standardization results. Refer Section 2.10
NO
Contact Ciba Corning.
YES
Is the printout poor quality?
NO
The printer may not be set up to print QC, sample or standardization results. Refer Section 2.10.
YES
Check printer ribbon is fitted correctly. Refit or fit new ribbon as necessary, Section 5.10.

IF FAULT PERSISTS
CONTACT CIBA CORNING OR
DISTRIBUTOR

6.3 Error Messages

The error message list is intended to help users rectify specific faults by providing reference to Troubleshooting chart(s) or by giving alternative action.

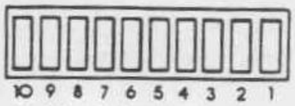
Message	Action or Chart Reference
A/D FAILED-REPEAT ?	If repeat test fails contact Ciba Corning, or distributor.
BUBBLE - FLUSH ?	Chart 6
BUBBLE IN QC	Chart 6
BUBBLE IN UR SLOPE	Chart 6
CAL DRIFT	Chart 3
CAL FAILED - REPEAT?	Chart 3 or 9
CAL OUT OF RANGE	Chart 3
CAL UNSTABLE	Chart 3
D/A FAILED - REPEAT?	If repeat test fails contact Ciba Corning, or distributor.
HI QC:Na=150 K=*.**	Chart 2
HI QC:Na=*** K=7.50	Chart 2
K OVER RANGE	Chart 2
K UNDER RANGE	Chart 2
K UNSTABLE	Chart 4
LOW QC:Na=117 K=*.**	Chart 2
LOW QC:Na=*** K=3.10	Chart 2
MID QC:Na=139 K=*.**	Chart 2
MID QC:Na=*** K=4.50	Chart 2
Na/K UNSTABLE	Chart 4
Na OVER RANGE	Chart 2
Na UNDER RANGE	Chart 2
Na UNSTABLE	Chart 4
Na=145 K=*.** mmol/L	Chart 2
Na=*** K=4.20 mmol/L	Chart 2
SAMPLE NOT DETECTED	Chart 6 or 9
SAMPLER FAILED	Chart 9
SAMPLING FAULT	Chart 5 or 6
SLOPE FAILED-REPEAT?	Chart 3
SLOPE OUT OF RANGE	Chart 3
SLOPE UNSTABLE	Chart 3
UR. SLP NOT DETECTED	Chart 6
!!!!!!!!!!!!!!!!!!!!	Contact Ciba Corning, or distributor.

NOTE: **Refer to Appendix C, Autosampler Operation, for Chart 9.**

6.4 Status Indicators

There are ten LEDs (Light Emitting Diodes), located under the status indicators cover on the rear panel. These will aid the user in diagnosing faults.

LED number	Check
1	a.c. power secondary
2	+12V
3	+5V
4	-5V
5	cal/flush solenoid
6	microprocessor
7	slope solenoid
8	peristaltic pump motor
9	not used
10	micro switch



Open the status indicators cover and check that:

1. LEDs 1 to 4 are on. If any of these LEDs are off contact Ciba Corning.
2. LED 6 is flashing. If it is not flashing, disconnect and reconnect the line cord. If LED 6 still does not flash, contact Ciba Corning.
3. Carry out a manual 2-point standardization, Section 3.5. During this routine LEDs 5 and 7 should come on and go off. LED 8 should come on/go off/change brightness. If any of the LEDs fail contact Ciba Corning.
4. Repeat the 2-point standardization. During this routine raise the sample area cover and check that:

   a) the pump rotor moves. If it does not contact Ciba Corning.

   b) Cal/Flush solution is supplied to the weir.

   c) Slope solution can be seen moving through the electrode block.

   If the conditions in (b) and (c) are not met, check that the Cal-Pak does not need replacing and that the tubes are below the level of solution. Check the pump tube cassette for blockages, Section 5.9. Replace solenoids if necessary, Section 5.17.

   Lower the sample area cover.

5. Raise and lower the sample probe. If LED 10 does not come on and go off in synchronism with the probe movement, check that the micro switch is connected correctly (Section 5.16). Replace if necessary.

Close the status indicators cover.

7.1 Ordering Information

When ordering spares or accessories for the 614, please give the following information to your Ciba Corning distributor.
614 Serial Number.
Catalog Number of Part (Cat.)
Description
Quantity Required

This will make sure that your order is dealt with quickly and efficiently.

The number shown in the third column (Quantity) is the quantity of items that are supplied against the stated Catalog Number. If the quantity is greater than 1, then only multiples of that quantity can be supplied.

7.2 Spares and Accessories

Cat.	Description	Quantity
478637	Printer ribbon cassette	1
478638	Printer paper	2 rolls
478536	Security key	1
478648	Fuse, 1A, time delay/slo-blo	2
001 42 498X	Line cord, without plug	1
858 040 001	Line cord, with plug, USA only	1
476273	Reference electrode, contains reference electrode cassette, reference electrode inner, KCl fill solution and '0' rings	1 kit
478615	Stat Service Kit, comprising:	
478509	Reference electrode inner, with KCl fill solution	1
478498	Reference electrode refill, contains reference electrode cassette, KCl fill solution and '0' rings	1 kit
476270	K^+ electrode plus '0' ring	1 kit
476266	Na^+ electrode plus '0' ring	1 kit
478634	Probe and tubing kit	1 kit
478653	Connecting tubing kit	1 kit
478842	Solenoid assembly	1
478639	Pump tube cassette	1
478645	Clot removal line, 0.5 m (19 1/2 inches)	1 pack
478624	Printer paper spindle	1
478694	Printer cover	1
478633	Weir cover	1
478700	Deproteinizer, pack of 5	1 pack
478701	Conditioner, pack of 5	1 pack
478535	$Na^+/K^+/Ca^{++}$ Electrode Fill Solution, pack of 3, with '0' ring	1 pack
478822	Reference Electrode Fill Solution, pack of 4, with '0' ring	1 pack
478542	Slope inlet block	1
478841	Manifold	1
478824	Manifold gasket	1
478825	Manifold plug	1
478823	Manifold and solenoid assembly	1
478673	Sample detector (inlet)	1
478674	Sample detector (outlet)	1
478623	Probe micro switch	1
478115 (USA) or	Sample cups, pack of 1000	1 pack
001 26 074P (non USA)	Sample cups, pack of 1000	1 pack
478696	Na^+/K^+ Capillary kit, contains 100 x 100 µL capillaries, 100 adaptors and 200 caps	1 kit
478698	pH/Blood gas/Na^+/K^+ capillaries, 100 µL, pack of 100	1 pack
478647	Capillary adaptors, pack of 100	1 pack
478693	Caps for 100 µL capillaries, pack of 200	1 pack
478526	Transfer pipetts, polyethylene, pack of 100	1 pack
478609	Ampule breakers, pack of 1000	1 pack
614 89 003N	614 Service Manual	1
478626	Urine starter pack, contains,	
-	Dispenser, 2 mL graduated in 0.1 mL steps	1
478543	Urine diluent, 500 mL,	1 bottle
-	Rack for sample cups,	1
478544	Urine Slope Standard, 50 x 1 mL ampules	1 pack

7.3 Solutions

Cat.	Description	Quantity
478541	Calibrants and Reagents Pack, comprising: 4 Cal-Paks and 4 Deproteinizer/Conditioner Packs	1 pack
478700	Deproteinizer, pack of 5	1 pack
478701	Conditioner, pack of 5	1 pack
478543	Urine Diluent, 500 mL	1 bottle
478544	Urine Slope Standard, 100 mmol/L Na^+ and 120 mmol/L K^+, 50 x 1 mL ampules	1 pack
478652	Certain ISE, Lo, Mid and Hi QC Material, 10 x 0.5 mL ampules each level	1 pack
478535	$Na^+/K^+/Ca^{++}$ Electrode Fill Solution, pack of 3, with 'O' ring	1 pack
478822	Reference Electrode Fill Solution, pack of 4, with 'O' ring	1 pack

8.1 Quality Control Checks

The 614 Na^+/K^+ Analyzer has been designed to provide fast and accurate determinations of undiluted whole blood, serum and plasma, and diluted urine. The latest Ciba Corning technology has been incorporated in the 614 to assure the validity of the final results.

However, the final result can be affected by factors other than instrument malfunction, such as sample handling and storage. Ciba Corning recommend therefore, that a Quality Control program is set up to monitor instrument and operator performance. Because the needs of each laboratory are different, due to size of workload, number of hours worked, statutory regulations, etc., no attempt has been made to formulate a rigid program.

The following notes are designed to assist you in formulating a Quality Control program.

1. The 614 has the capability to remind the user up to three times in every 24 hours that a QC check is required. The times of the QC prompts are selected by the user and can be displayed on the hour or half-hour with a minimum interval of 2 hours. Refer to Section 3.1, Menu Routing Maps, for details on accessing this routine. If a QC check is performed during the hour preceding the prompt (using the (QC NOW ?) routine in the Check/Service menu), that prompt is suppressed. The QC prompt display is enabled for one hour, however, sample measurements can still be carried out during this time. If the QC check is not performed within the hour, that prompt is suppressed. Refer to Section 3.7, for detailed information on the (QC NOW ?) routine.
2. QC material can also be measured as an ordinary sample, using the (ANALYZE BLOOD ?) mode.
3. Use only Ciba Corning QC materials, as some non-Ciba Corning QC samples may not give expected values due to the matrix of the material. Human based QC samples may also give results that are different to expected flame photometer values because of differences in pH, bicarbonate or protein levels.
4. Some QC materials contain substances which are known to damage the electrodes, or affect electrode response. Do not use any QC material containing ethylene glycol, caesium ions or excessive amounts of ammonium ions.
5. If you report your results to a quality control statistical program, make sure they are informed of the change in method, i.e. Ciba Corning 614 ISE Na^+/K^+ Analyzer.

References

The following references are recommended for further information on Quality Control.

Rand, RN, Eilers, RJ, Lawson, NS, et al (eds). Quality assurance in health care: A critical appraisal in clinical chemistry: AACC and CAP, Washington D.C., 1980.
Westgard, JO, Carey, RN, Wold, S. Clin Chem 1974; 20: 825.
Barnett, RN. Am J Clin Pathol 1968; 50: 671.
Tonks, DB. Can J Med Technol 1968; 30: 38.
Natrella, MG. Experimental statistics. Nat Bur Stand Handb 91, U.S. Government Printing Office, Washington DC, 1963; pp 4 - 1 to 4 - 7 and Table A21, p T-3

8.2 Correlation Adjust

The 614 is set during manufacture to read similar values to a Flame Photometer for Na^+ and K^+ samples. If a user wishes to change the 614 displayed values to correlate with other equipment, the following series of experiments, at different values of Na^+ and K^+, should be carried out.

NOTE: If SECURITY ON ? has been selected, the CHANGE SLOPE/INTCPT? routine will only be accessible if the security key is fitted to the data output socket.

Choice of Specimens

Excess sera or plasma from hospitalized patients having sodium and/or potassium levels assayed should be used for correlation. Immediately after analysis in the hospital, an aliquot of the serum or plasma sample should be used to fill a 2 mL container. The tube should then be capped and refrigerated until delivery for analysis per this protocol.

Distribution of Samples

Samples should have values (as measured by the 614) distributed as shown:

Sodium mmol/L	<115	115-124	125-134	135-145	146-155	>155
%	10	10	10	40	20	10

Potassium mmol/L	<2.0	2.0-2.9	3.0-3.4	3.5-5.0	5.1-6.0	>6.0
%	10	10	10	40	10	20

Number of Specimens

100 serum or plasma specimens.

Analyses to be Performed

Analyte	Methodology
Sodium Potassium	desired equipment and ISE
Bicarbonate	clinical chemistry analyzer, measured as tCO_2
pH	blood gas analyzer
Total protein	biuret
Triglycerides	enzymatic
Cholesterol	enzymatic

Acceptable Values

Bicarbonate	20-36 mmol/L
pH	7.3-7.7
Total protein	50-80 g/L
Triglycerides	0.3-2.0 g/dL
Cholesterol	3.1-8.5 mmol/L

Analytical Protocol

Specimens identified as suitable for inclusion in this protocol should be analyzed within 1 hour of collection or stored refrigerated as described in Choice of Specimens.

Specimens should be analyzed in duplicate and the mean value recorded; randomized in batches of not more than 10 single specimens. Repeat analyses of the same 3 specimens (low, middle and high) should be included in all batches on both the desired equipment and ISE so that between-batch precision is maintained. Each specimen should be analyzed on the 614 and the desired equipment as soon as possible, ideally within 5 minutes of each other.

Calibration of the Desired Equipment

The desired equipment should be calibrated following the manufacturer's instructions. Internal quality assurance will be performed against gravimetrically reconstituted NBS SRM 909 or quality control materials with definitive assigned or consensus values, for each batch of 10 analyses.

NOTE: The correlation factors in the 614 must be reset to:
Na^+ and K^+ slope = 1.00
Na^+ and K^+ intercept = 0.00
using the CHANGE SLOPE/INTCPT? routine (Section 3.1), before carrying out the paired sample analysis.

Analysis of Results

All valid batches of results should be analyzed by the method of Deming (1) incorporating the ratio of variances between the desired method and the direct ISE, i.e. accounting for errors on both axes. The correlation must be carried out with the desired or reference method along the X-axis and the 614 along the Y-axis. In an ideal situation the coefficient of correlation should be better than 0.98 with no outliers. The intercept and slope values obtained from the $y = mx + c$ correction may then be directly input into the 614 using the CHANGE SLOPE/INTCPT? routine, Section 3.1. If the correlation is not plotted in this way, the incorrect correlation factors will be input into the 614.

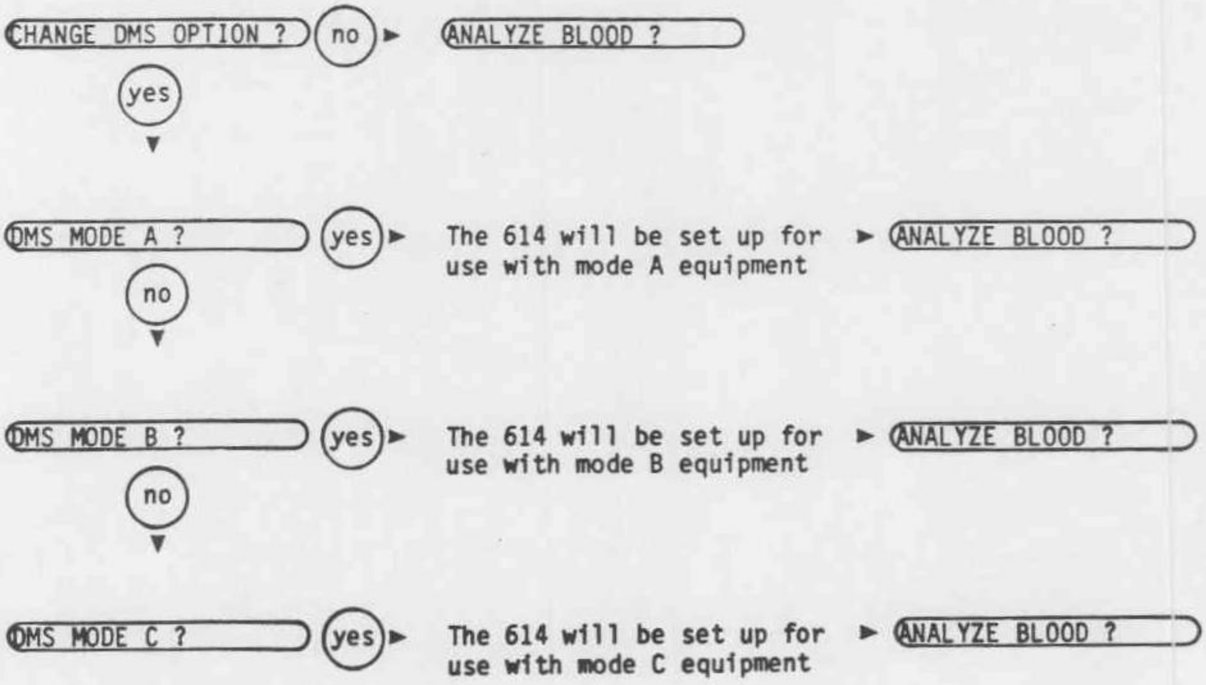
Reference

1. Cornbleet and Gochman, Clin Chem 1979; 25/3: 432-438.

9.1 Setting DMS

This routine allows the 614 to be set up for use with external equipment. Refer to Appendix B, Data Transfer Specification, for details of protocols for peripheral equipment.

Mode A = baud rate 300, used for unidirectional printers, i.e. Axiom™ EX 801
Mode B = baud rate 7200, used for bidirectional computers, i.e. Ciba Corning data management systems.
Mode C = baud rate 1200, used for bidirectional printers, i.e. Ciba Corning 101 printer, Ciba Corning 102 roll printer.


CHANGE DMS OPTION ?
no
ANALYZE BLOOD ?
yes
DMS MODE A ?
yes
ANALYZE BLOOD ?
no
DMS MODE B ?
yes
ANALYZE BLOOD ?
no
DMS MODE C ?
yes
ANALYZE BLOOD ?

The 614 will be set up for use with mode A equipment

The 614 will be set up for use with mode B equipment

The 614 will be set up for use with mode C equipment

TM Axiom Corp., 5923 San Fernando Road, Glendale, CA 91202, USA

10.1 Summary of the Test

Sodium and potassium ions (together with chloride and bicarbonate ions) in body fluids play an important part in maintaining normal water distribution between cells, plasma and interstitial fluid, because of the osmotic pressure they exert. In addition to their influence on the distribution of body water, sodium and potassium also play a part in providing the correct environment for normal muscle contraction.

Early methods for determining sodium and potassium levels in physiological fluids were time consuming and required considerable sample manipulation. For example, sodium was most frequently assayed chemically by precipitation as zinc uranyl acetate which was then determined colorimetrically and a similar method was recommended for potassium after precipitation as the cobaltinitrite salt. (1,2).

During the 1940's flame photometers became commercially available, and over the years, these have been extensively developed to include internal standards and microprocessors which facilitate their use. In general, these systems are reliable and give reasonably fast results, but they do suffer from several disadvantages, especially in Intensive Therapy and Coronary Care units where many sodium and potassium analyses are required. Whole blood cannot be analyzed without prior separation and pre-dilution, which introduces a considerable time delay, and specialized services such as deionized water and propane gas or compressed air supplies are not always available. The flame and gas could also present a considerable hazard in some areas.

The 614 is a direct potentiometric ISE analyzer and does not require sample pretreatment techniques. It can measure whole blood on very small samples (approximately 35 µL) taken directly from capillaries, a great advantage in paediatric cases. This means that samples can be determined rapidly and at the patient's bedside, if necessary. The instrument is self-contained requiring no external services other than electricity and hence many potential hazards have been eliminated. Thus, it is ideal for placement in Intensive Care Units or even in operating theatres to monitor a patient almost continuously during the course of an operation. Direct potentiometric ISE's have one further advantage over flame photometers - the ions under investigation are being monitored in their usual physiological matrix which should approximate more closely to their 'in-vivo' situation.

This is an important difference which can have considerable clinical significance. Methods of analysis employing dilution, like flame photometers, will give erroneously low sodium values (pseudohyponatremia) on samples containing elevated lipid and/or protein levels. These insoluble lipids and partially soluble proteins occupy space in the physiological matrix which is not available for the ionic species, and the flame photometer over-dilutes the electrolytes. Hence, the 614 will still detect a 'normal' sodium level whereas the dilution method shows an abnormally low level which could result in misdiagnosis. (3,4,5).

References

1. King, EJ, Haslewood, GAP, Delory, GE, Beall, D. Lancet 1942; 47.
2. Jacobs, HRD, Hoffman, WS. J Biol Chem 1931; 93: 685.
3. Forrest, ARW, Shenkin, A. Lancet 1980; 1256.
4. Thompson, FD. British J of Hospital Medicine 1979; 46.
5. Buckley, BM, Broughton, PMG, Russell, LJ, Carter, TJN. Annals of Clin Biochem 1984; 21: 75.

The principle is based on the measurement of a potential developed by the Ion Selective Electrodes (ISE's) with respect to the reference electrode. In an electrolyte solution most simple salts dissociate to their ions. An electrical exchange reaction occurs between the relevant electrode and the ions, which produces a potential between the ion selective electrode and the reference electrode. The reference electrode provides a fairly constant potential irrespective of the matrix being analyzed.

The electrode potential is given by the theoretical formula of Nernst:

$$E = Eo + \frac{RT}{NF} \ln[fC]$$

Where: E = Potential at ion selective electrode
Eo = Standard potential
N = Number of electrons related to the reaction
F = Faraday's constant
T = Absolute temperature
[C] = Concentration of ion
f = Activity coefficient
R = Gas constant

NOTE: Since the ionic strength of whole blood, plasma and serum is relatively constant over the physiological range, the activity coefficient (f) of sodium and potassium ions can be assumed to be a constant. In urine mode the actual ionic strength and pH remains relatively constant because of the effect of the dilution with Ciba Corning Urine Diluent, which contains ionic buffers.

In practical terms when compared with a reference electrode at a temperature of 25°C

For Na^+:

$$E_{Na}=59.16 \times \log C_{Na} \text{ mV}$$

and for K^+:

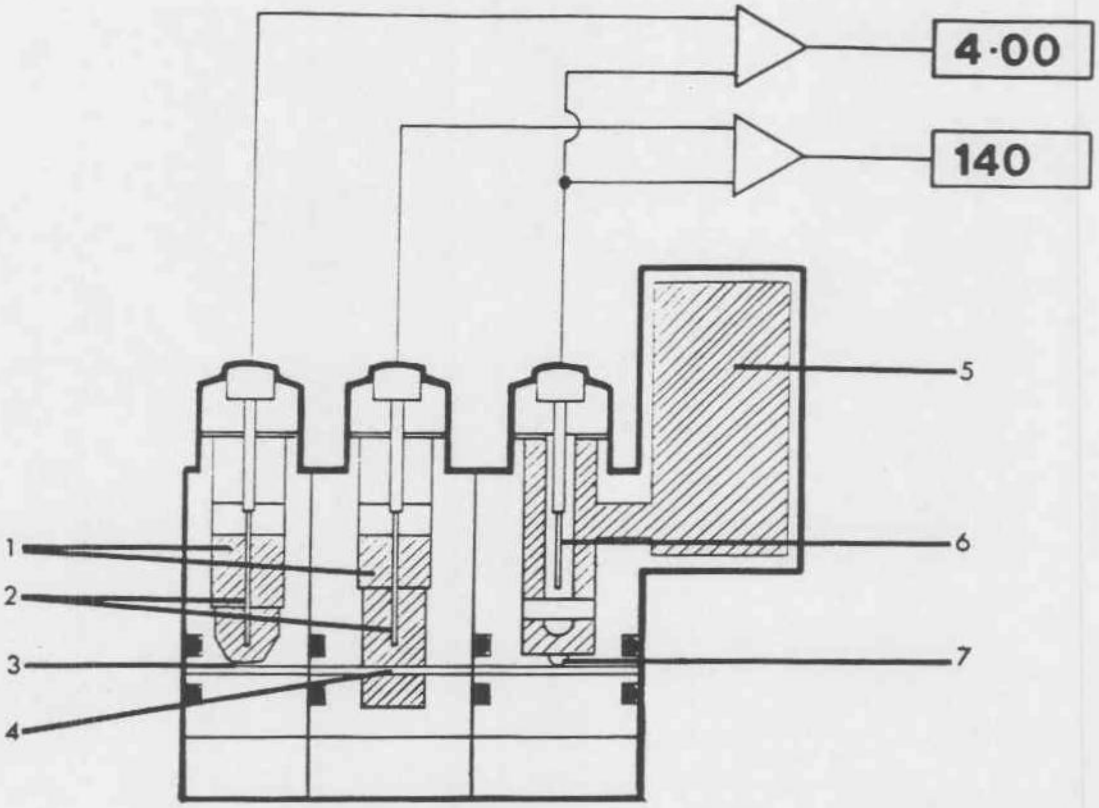
$$E_K=59.16 \times \log C_K \text{ mV}$$

Where: E_{Na} = Potential difference of Na^+ electrode system
E_K = Potential difference of K^+ electrode system
C_{Na} = Na^+ concentration
C_K = K^+ concentration

Therefore, it is possible to measure the ionic concentration of Na^+ and K^+ by measuring the electrode potentials.

10.3 Ion Selective Electrodes

Figure F10.3 K⁺, Na⁺ and Reference Electrodes



K^+, Na^+ and Reference Electrodes

ITEM	DESCRIPTION
1.	Na^+/K^+ electrode fill solution.
2.	Silver chloride coated silver wire.
3.	Potassium sensitive P.V.C. membrane.
4.	Sodium sensitive glass capillary.
5.	Reference electrode fill solution.
6.	Nafion^{TM} inner.
7.	Reference membrane.

The ion selective electrode module is shown in the figure.

The potassium ion selective electrode consists of a valinomycin based membrane. The valinomycin is in contact with the sample on one side, and with the electrode fill solution on the other side. Electrical connection is via a Ag/AgCl wire.

The sodium ion selective electrode consists of a glass capillary, which is selective to sodium ions. The sample passes through the capillary, with the outer surface in contact with the electrode fill solution. Electrical connection is via a Ag/AgCl wire.

TM Dupont, Wilmington, Delaware, USA.

10.3 Ion Selective Electrodes (cont)

The reference electrode consists of a shell filled with saturated KCl, separated from the sample by a cellulose membrane. Electrical connection is via a Ag/AgCl wire, coated with Nafion^{TM}, an ion permeable polymer.

The potentials at the Na^+ and K^+ electrodes, with respect to the reference electrode, are processed by differential amplifiers with high impedance inputs. The microprocessor converts the analog signals to a digital format and performs an anti-log conversion and plateau sensing.

The output signals of the Na^+ and K^+ channels are sampled every half second. Each pair of readings is compared with the previous readings, and each consecutive pair must be within ±73 µV for Na^+ and ±128 µV for K^+ of the previous average in serum mode. Ten pairs of readings must satisfy this criteria. For short term drift the ten consecutive pairs must also be within a span of ±183 µV for Na^+ and ±319 µV for K^+ in serum mode.

The 614 also monitors the drift between calibrations. If the drift exceeds ±2 mmol/L Na^+ or ±0.1 mmol/L K^+ a further calibration will be carried out before the 614 will allow sample or QC determinations.

In automatic standardization mode the time between calibrations is calculated to optimize stability based on the drift between the two previous calibrations. The time interval will be between 10 and 60 minutes; slope measurements are carried out every fourth calibration.

TM Dupont, Wilmington, Delaware, USA.

11.1 Range

Whole Blood, Serum Plasma and QC Material	80 to 200 mmol/L Na$^+$	0.50 to 9.99 mmol/L K$^+$
Urine	10 to 350 mmol/L Na$^+$	5 to 250 mmol/L K$^+$

11.2 Imprecision

The following specification assumes that a successful 2-point calibration has been carried out before sample measurement.

The Coefficient of Variation for 20 replicate serum, plasma or whole blood samples, analyzed in the same batch, is 1.5% or less for Na$^+$ and K$^+$.

The Coefficient of Variation for 1 serum, plasma or whole blood sample, analyzed on 20 consecutive days, is less than 2% for Na$^+$ and K$^+$.

For 20 replicate urine samples, analyzed in the same batch, the imprecision is ±4 mmol/L or 4% CV, whichever is the greater.

To meet the urine specification the pipette and dilutor used must comply with the following:

Accuracy 1.0%
Imprecision 0.5% CV

The SMI micro/pettor^{TM} range of pipettes and Ciba Corning Diluent Dispenser are suitable.

11.3 Stability

The measured calibration value will change by less than ±2 mmol/L Na$^+$ and ±0.1 mmol/L K$^+$ in a 1 hour period, at constant ambient temperature.

11.4 Measurement Time

A sample measurement result will be displayed within 35 seconds of pressing the yes control when (ANALYZE BLOOD ?) or (ANALYZE URINE ?) is displayed. The measurement time, from sample to sample, is 60 seconds.

TM Scientific Manufacturing Industries, Emeryville, CA, USA.

11.5 Samples

Types

Whole blood, plasma - using lithium heparin as anti-coagulant, refer to Section 4.3. Free from haemolysis, less than 1 hour old and, if stored, kept at a temperature between 10°C and 30°C. Fresh samples can be analyzed at temperatures up to 40°C; however, storage must be within the stated temperature range.

Serum, - free from haemolysis, within a sample temperature range of 5°C to 40°C on presentation to the instrument.

QC material - Ciba Corning, within a sample temperature range of 5°C to 40°C on presentation to the instrument.

Urine - to be diluted 1 part sample to 9 parts Urine Diluent, within a sample temperature range of 5°C to 40°C on presentation to the instrument. Urine samples must not be collected into a strong acid preservative.

Sample Presentation

By syringe, cup, blood collection tube, centrifuge tube, vial, vacutainer^{TM} or capillary (using an adaptor) to the sample probe, when it is raised to the appropriate position.

Standard Presentation

The Calibration and Slope Solutions are contained within the instrument. The Calibration Standard is pumped to the weir during the standardization sequence and is available to the sample probe when the probe arm is lowered. The Calibration Standard is also used to flush the electrode block after each sample determination. The Slope Solution is pumped directly to the electrode block.

Diluted Urine Slope Standard is manually presented to the sample probe in a suitable cup or container, in the same way as a sample.

Volume Required

Blood Sample	35 µL (nominal)
Urine Sample	150 µL (nominal) sample pre-diluted 1 in 10 with Ciba Corning Urine Diluent
Urine Slope	150 µL (nominal) slope pre-diluted 1 in 10 with Ciba Corning Urine Diluent

11.6 Readout

20 character, alphanumeric, vacuum fluorescent display. For a complete list of displayed messages refer to Appendix A.

TM Becton, Dickinson, Orangeburg, NY 10962-1294, USA.

11.7 Warm-up

The 614 is designed to be connected to an a.c. supply at all times and, when used as recommended will not require a warm-up period. However, if the 614 must be disconnected from the a.c. supply, shutdown the 614 as described in Section 3.8. For periods of up to 30 minutes the 614 will retain the Set-Up menu parameters and can resume operation immediately the power is restored.

11.8 Environmental Conditions

Operation

Temperature Range 10°C to 35°C
Maximum Relative Humidity 85% at 35°C (non condensing)

Transportation

Temperature Range 0°C to 45°C
Maximum Relative Humidity 95% at 45°C (non condensing)

11.9 Power Requirements

Fuse Rating	Two 1A fuses (time delay or slo-blo)	
Power Rating	50VA	
Voltage	100V (85 to 110V)	50/60Hz
	120V (102 to 132V)	
	220V (187 to 242V)	
	240V (204 to 264V)	

11.10 Size

Width: 280 mm (11 inches)
Depth: 270 mm (10 3/4 inches)
Height: 330 mm (13 inches)

11.11 Weight

6.36 kg (14 lb) 614 only
14 kg (31 lb) (approx) 614 with accessories, carton and packaging.

11.12 Reagents

Please refer to Section 7.3 for a complete list of reagents for use with the 614.

Dilution

The only Ciba Corning Standard for use with the 614 that requires dilution is the Urine Slope Standard, which is diluted 1 part Standard to 9 parts Ciba Corning Urine Diluent.

Storage

Solutions should be stored at 4 to 25°C away from direct sunlight. Prolonged exposure to the atmosphere should be avoided as it is likely to affect the concentration of solutions.

Purification

No purification is required when using Ciba Corning reagents.

Values

Cal/Flush Solution	Na	140.0 mmol/L
	K	4.00 mmol/L
Slope Standard	Na	110.0 mmol/L
	K	8.00 mmol/L
Urine Slope Standard	Na	100.0 mmol/L
	K	120.0 mmol/L

The menu or routine in which the message is displayed is shown, with the instrument's status at that time. Also shown is the instrument response to answering yes to a question. Values shown in messages are examples only.

A/D FAILED - REPEAT?	System Test routine - Repeats A/D test if results are outside specification.
A/D OK	System Test routine - A/D test results within specification.
A/D TEST ?	System Test routine - Tests Analogue to Digital converter.
ANALYZE BLOOD ?	Operating menu - Ready for blood, serum, or plasma sample measurement.
ANALYZE URINE ?	Operating menu - Ready for urine sample measurement.
AUTO PRIME ?	Check/Service menu - Primes hydraulic system automatically.
AUTOSAMPLER ?	Autosampler message - Refer to Appendix C.
AUTOSAMPLER START ?	Autosampler message - Refer to Appendix C.
BLOOD ANALYSIS ?	Operating menu - Selects blood analysis mode when 614 is in ANALYZE URINE ? mode.
BUBBLE IN QC	QC Now routine - Displayed if a bubble has been detected during sampling. The 614 will flush and allow measurement to be repeated.
BUBBLE IN UR. SLOPE	Operating menu - Displayed if a bubble has been detected during sampling. The 614 will flush and allow measurement to be repeated.
BUBBLE - FLUSH ?	Operating menu - Allows sample to be flushed if a bubble has been detected. If measured, result will be flagged on the printer.
CAL DRIFT	Operating and Check/Service menus - Displayed if calibration result has drifted. Message alternates with CALIBRATING.
CAL FAILED - REPEAT?	Operating and Check/Service menus - Repeats calibration following failed calibration result.
CAL OUT OF RANGE	Operating and Check/Service menus - Displayed if calibration result is out of range. Message alternates with CALIBRATING.
CAL UNSTABLE	Operating and Check/Service menus - Displayed if calibration result is unstable. Message alternates with CALIBRATING.
CALIBRATING	Operating and Check/Service menus - Displayed when measuring cal/flush solution. Message can alternate with PLEASE WAIT, CAL DRIFT, CAL UNSTABLE and CAL OUT OF RANGE.
CALIBRATION OK	Operating and Check/Service menus - Calibration results within specification. Message alternates with Na=140 K=4.00 mmol/L.
CAL-PAK CHANGED ?	Service Reagents routine - Checks that calibrants have been changed.
CAL-PAK REMOVED ?	Drain/Prime routine - Checks that calibrants have been removed prior to draining system.
CAL-PAK REPLACED ?	Drain/Prime routine - Checks that calibrants have been replaced in the 614. Message alternates with DRAINING COMPLETED.

CANCEL CORRELATION ?	Change Slope/Intcpt routine - Cancels Slope and Intercept correlation. (Resets to Slope = 1.00, Intercept = 0.00).
CANCEL QC LIMITS ?	Change QC Limits routine - Cancels flagging of QC measurements which are outside preset QC ranges.
CANCEL QC PROMPTS ?	Change QC Prompt routine - Cancels all three of the daily QC prompts.
CANCEL REF RANGES ?	Change Ref Ranges routine - Cancels flagged printout of samples which are outside preset reference ranges.
CHANGE ANALYTES ?	Set-Up menu - Allows selection of Na^+ only, K^+ only or Na^+ and K^+ mode.
CHANGE DATE/TIME ?	Set-Up menu - Allows date and time to be changed.
CHANGE DMS OPTION ?	Set-Up menu - Allows data management system (DMS) parameters to be set.
CHANGE LANGUAGE ?	Set-Up menu - Allows selection of English or alternative language for alphanumeric display.
CHANGE PRINT OPTION?	Set-Up menu - Allows selection of print options.
CHANGE QC LIMITS ?	Set-Up menu - Allows minimum and maximum values for LOW, MID and HI levels of quality control sera to be changed.
CHANGE QC PROMPT ?	Set-Up menu - Allows three daily QC prompts to be enabled/disabled and prompt times to be changed.
CHANGE REF RANGES ?	Set-Up menu - Allows the acceptable ranges for blood, serum and plasma sample measurements to be changed.
CHANGE SECURITY ?	Set-Up menu - Allows security key option to be changed.
CHANGE SLOPE/INTCPT?	Set-Up menu - Allows ISE/Flame bias correction to be changed.
CHANGE STD MODE ?	Set-Up menu - Allows selection of automatic or manual mode.
CHECK OR SERVICE ?	Operating menu - Allows exit to Check/Service menu.
CHECK SET-UP	Operating menu - Displayed if 614 has performed a self diagnostic test and reset all Set-Up menu parameters to the default values. Alternates with ANALYZE BLOOD ?, ANALYZE URINE ?, STANDARDIZE ?, LAST RESULT RECALL, AUTOSAMPLER ? or standardization error messages.
CONDITION ?	Power Up and Depro/Condition routines - Allows electrode conditioning (or disinfection) to be carried out.
CONDITIONING	Power Up and Depro/Condition routines - Displayed during conditioning (or disinfection) procedure. Message alternates with WAIT 5:00 MINUTES.
CONNECT PROBE	Autosampler message - Refer to Appendix C.
CORRELATION ADJUST ?	Power Up routine - Allows slope and intercept points to be set.
D/A FAILED - REPEAT?	System Test routine - Repeats D/A test if results are outside specification.
D/A OK	System Test routine - D/A test results within specification.
D/A TEST ?	System Test routine - Tests Digital to Analogue converter.
DATE = JAN 1 1986 ?	Change Date/Time routine - Final check of date selected.
DAY = 1 ?	Change Date/Time routine - Selects day.
DEPRO / CONDITION ?	Check/Service menu - Allows electrode deproteinizing and conditioning to be carried out.
DEPROTEINIZE ?	Depro/Condition routine - Allows electrode deproteinizing (or disinfection) to be carried out.
DEPROTEINIZING	Depro/Condition routine - Displayed during deproteinizing (or disinfection) procedure. Message alternates with WAIT 5:00 MINUTES.

DISP/PRINTER TEST ?	System Test routine - Tests display and printer.
DMS MODE A ?	Change DMS Option routine - Sets up the 614 for use with unidirectional printers.
DMS MODE B ?	Change DMS Option routine - Sets up the 614 for use with bidirectional computers.
DMS MODE C ?	Change DMS Option routine - Sets up the 614 for use with bidirectional printers.
DRAIN ?	Check/Service menu - Drains hydraulic system.
DRAINING COMPLETED	Drain/Prime routine - Displayed when hydraulic system is drained. Message alternates with CAL-PAK REPLACED ?.
ELECTRODE O/P TEST ?	System Test routine - Tests Na$^+$ and K$^+$ electrode response using a test solution.
FLUSHING	Operating and Check/Service menus - Displayed when hydraulic system is being flushed following deproteinizing/conditioning, or if sampling is interrupted.
HHHHHHHHHHHHHHHHHHHH	Power Up and System Test routines - Part of disp/printer test. During System Test the display is frozen for 10 seconds and the message is printed. To continue before the 10 seconds has elapsed, press yes or no.
HIGH QC ?	QC Now routine - Ready to measure HI level QC serum.
HI QC: K MAX=7.70 ?	Change QC Limits routine - Selects maximum K$^+$ value for HI QC.
HI QC: K MIN=7.30 ?	Change QC Limits routine - Selects minimum K$^+$ value for HI QC.
HI QC: K=7.30-7.70 ?	Change QC Limits routine - Final check of minimum and maximum K$^+$ values selected for HI QC.
HI QC: Na MAX=152 ?	Change QC Limits routine - Selects maximum Na$^+$ value for HI QC.
HI QC: Na MIN=148 ?	Change QC Limits routine - Selects minimum Na$^+$ value for HI QC.
HI QC: Na=148-152 ?	Change QC Limits routine - Final check of minimum and maximum Na$^+$ values selected for HI QC.
HI QC: Na=150 K=7.50	QC Now routine - HI QC result. If value is outside preset QC limits this message alternates with OUT OF QC LIMITS and the result is flagged on the printer.
HI QC: Na=150 K=*.**	QC Now routine - Displayed alternately with K OVER RANGE, K UNDER RANGE or K NOT SELECTED.
HI QC: Na=*** K=7.50	QC Now routine - Displayed alternately with Na OVER RANGE, Na UNDER RANGE or Na NOT SELECTED.
HOUR = 7:00 ?	Change Date/Time routine - Selects hour.
IDIOMA = ESPANOL ?	Power Up and Change Language routines - Selects Spanish for alphanumeric display.

III to LOW

IIIIIIIIIIIIIIIIIIII	Power Up and System Test routines - Part of disp/printer test. During System Test the display is frozen for 10 seconds and the message is printed. To continue before the 10 seconds has elapsed, press yes or no.
K INTCPT = 0.15 ?	Change Slope/Intcpt routine - Selects K$^+$ intercept value.
K MAX = 4.70 ?	Change Ref Ranges routine - Selects maximum acceptable K$^+$ sample value.
K MIN = 3.70 ?	Change Ref Ranges routine - Selects minimum acceptable K$^+$ sample value.
K NOT SELECTED	Operating and Check/Service menus - Displayed alternately with sample or QC Na$^+$ result or a Na$^+$ error message if Na ONLY ? was selected in Change Analytes routine.
K ONLY ?	Change Analytes routine - Selects measurement of K$^+$ levels only.
K OVER RANGE	Operating menu and QC Now routine - Displayed if K$^+$ result is overrange. Message alternates with sample or QC Na$^+$ result or a Na$^+$ error message, see NOTE 7.
K RANGE=3.70-4.70 ?	Change Ref Ranges routine - Final check of acceptable K$^+$ sample range.
K SLOPE = 0.96 ?	Change Slope/Intcpt routine - Selects K$^+$ slope value.
K UNSTABLE	Operating menu and QC Now routine - Displayed if K$^+$ result is unstable. Message alternates with sample or QC result or a Na$^+$ error message, see NOTE 7.
K UNDER RANGE	Operating menu and QC Now routine - Displayed if K$^+$ result is underrange. Message alternates with sample or QC Na$^+$ result or a Na$^+$ error message, see NOTE 7.
LANGUAGE = ENGLISH ?	Power Up and Change Language routines - Selects English for alphanumeric display.
LANGUE = FRANCAIS ?	Power Up and Change Language routines - Selects French for alphanumeric display.
LAST RESULT RECALL ?	Operating menu - Recalls last result to display for 5 seconds. Printout shows time of analysis, not the time it was recalled.
LOW QC ?	QC Now routine - Ready to measure LOW level QC serum.
LOW QC: K MAX=3.40 ?	Change QC Limits routine - Selects maximum K$^+$ value for LOW QC.
LOW QC: K MIN=2.80 ?	Change QC Limits routine - Selects minimum K$^+$ value for LOW QC.
LOW QC: K=2.80-3.40?	Change QC Limits routine - Final check of minimum and maximum K$^+$ values selected for LOW QC.
LOW QC: Na MAX=120 ?	Change QC Limits routine - Selects maximum Na$^+$ value for LOW QC.
LOW QC: Na MIN=114 ?	Change QC Limits routine - Selects minimum Na$^+$ value for LOW QC.
LOW QC: Na=114-120 ?	Change QC Limits routine - Final check of minimum and maximum values selected for LOW QC.
LOW QC:Na=117 K=3.10	QC Now routine - LOW QC result. If value is outside preset QC limits this message alternates with OUT OF QC LIMITS and the result is flagged on the printer.

LOW QC:Na=117 K=*.**	QC Now routine - Displayed alternately with K OVER RANGE, K UNDER RANGE or K NOT SELECTED.
LOW QC:Na=*** K=3.10	QC Now routine - Displayed alternately with Na OVER RANGE, Na UNDER RANGE or Na NOT SELECTED.
MANUAL PRIME ?	Check/Service menu - Pressing and holding yes control will run the hydraulic pump and prime the system.
MEASURING	Operating and Check/Service menus - Displayed when measuring samples and QC sera. Message alternates with PLEASE WAIT.
MEASURING SLOPE	Operating and Check/Service menus - Displayed when measuring slope solution. Message alternates with PLEASE WAIT, SLOPE UNSTABLE or SLOPE OUT OF RANGE.
MEASURING UR. SLOPE	Operating menu - Displayed when measuring urine slope solution. Message alternates with PLEASE WAIT.
MID QC ?	QC Now routine - Ready to measure MID level QC serum.
MID QC: K MAX=4.70 ?	Change QC Limits routine - Selects maximum K^+ value for MID QC.
MID QC: K MIN=4.30 ?	Change QC Limits routine - Selects minimum K^+ value for MID QC.
MID QC: K=4.30-4.70?	Change QC Limits routine - Final check of minimum and maximum K^+ values selected for MID QC.
MID QC: Na MAX=141 ?	Change QC Limits routine - Selects maximum Na^+ value for MID QC.
MID QC: Na MIN=137 ?	Change QC Limits routine - Selects minimum Na^+ value for MID QC.
MID QC: Na=137-141 ?	Change QC Limits routine - Final check of minimum and maximum values selected for MID QC.
MID QC:Na=139 K=4.50	QC Now routine - MID QC result. If value is outside preset QC limits this message alternates with OUT OF QC LIMITS and the result is flagged on the printer.
MID QC:Na=139 K=*.**	QC Now routine - Displayed alternately with K OVER RANGE, K UNDER RANGE or K NOT SELECTED.
MID QC:Na=*** K=4.50	QC Now routine - Displayed alternately with Na OVER RANGE, Na UNDER RANGE or Na NOT SELECTED.
MINUTE = :00 ?	Change Date/Time routine - Selects minutes.
MONTH = JAN ?	Change Date/Time routine - Selects month.
mmol/L MODE ?	System Test routine - Selects mmol/L measurement during electrode output test.
mV MODE ?	System Test routine - Selects mV measurement during electrode output test.
Na AND K ?	Change Analytes routine - Selects normal measurement mode.
Na INTCPT = 0 ?	Change Slope/Intcpt routine - Selects Na^+ intercept value.
Na MAX = 145 ?	Change Ref Ranges routine - Selects maximum acceptable Na^+ sample value.
Na MIN = 135 ?	Change Ref Ranges routine - Selects minimum acceptable Na^+ sample value.

Na NOT SELECTED	Operating and Check/Service menus - Displayed alternately with sample or QC K$^+$ result or a K$^+$ error message if K ONLY ? selected in Change Analytes routine.
Na ONLY ?	Change Analytes routine - Selects measurement of Na$^+$ levels only.
Na OVER RANGE	Operating menu and QC Now routine - Displayed if Na$^+$ result is overrange. Message alternates with sample or QC K$^+$ result or a K$^+$ error message, see NOTE 6.
Na RANGE = 135-145 ?	Change Ref Ranges routine - Final check of acceptable Na$^+$ sample range.
Na SLOPE = 1.02 ?	Change Slope/Intcpt routine - Selects Na$^+$ slope value.
Na UNSTABLE	Operating menu and QC Now routine - Displayed if Na$^+$ result is unstable. Message alternates with sample or QC result or a K$^+$ error message, see NOTE 6.
Na UNDER RANGE	Operating menu and QC Now routine - Displayed if Na$^+$ result is underrange. Message alternates with sample or QC K$^+$ result or a K$^+$ error message, see NOTE 6.
Na= 50 K= 60 mmol/L	Analyze Urine routine - Urine sample result.
Na=100 K=120 mmol/L	Operating Menu - Urine slope result. Message alternates with URINE SLOPE OK.
Na=110 K=8.00 mmol/L	Operating Menu - Slope result. Message alternates with SLOPE OK.
Na=140 K=4.00 mmol/L	Operating Menu - Calibration result. Message alternates with CALIBRATION OK.
Na=145 K=4.20 mmol/L	Analyze Blood and System Test routines - Blood, serum, plasma or test solution result. If value is outside preset reference ranges this message alternates with OUT OF REF RANGE and the result is flagged on the printer.
Na=145 K=*.** mmol/L	Operating menu - Sample result, displayed alternately with K OVER RANGE, K UNDER RANGE or K NOT SELECTED. Urine results will not show the decimal point.
Na=*** K=4.20 mmol/L	Operating menu - Sample result, displayed alternately with Na OVER RANGE, Na UNDER RANGE or Na NOT SELECTED. Urine results will not show the decimal point.
Na=100.0 K=110.0 mV	System Test routine - Result of electrode output test.
Na/K UNSTABLE	Operating and Check/Service menus - Displayed if both channels are unstable. Message alternates with sample or QC result.
NO DATA AVAILABLE	Last Sample Recall routine - No samples have been analyzed.
OPEN PROBE	Operating and Check/Service menus - Instruction to open probe so that solution can be aspirated.
OUT OF QC LIMITS	QC Now routine - Displayed alternately with QC result if value is outside preset QC limits. The result is flagged on the printer.
OUT OF REF RANGE	Analyze Blood routine - Displayed alternately with sample result if value is outside preset reference ranges. The result is flagged on the printer.

PLEASE WAIT	Operating and Check/Service menus - Displayed alternately with MEASURING, MEASURING (UR) SLOPE and CALIBRATING.
PRIME ?	Check/Service menu - Primes hydraulic system.
PRIME AGAIN ?	Check/Service menu - Allows another prime routine to be carried out.
PRIMING	Check/Service menu - Displayed when system is being manually primed.
PRINTING SET-UP	Power Up routine and Set-Up menu - Displayed when integral printer is printing out parameters selected.
PRINT RESULTS ONLY ?	Power Up and Change Print Option routines - Allows printer to be set to print results only.
PRINT RESULTS&STDS ?	Power Up and Change Print Option routines - Allows printer to be set to print results, standardizations and error messages.
PROBE DISCONNECTED ?	Autosampler message - Refer to Appendix C.
PROBE IN HIGH QC ?	QC Now routine - Checks that probe is in HI QC.
PROBE IN LOW QC ?	QC Now routine - Checks that probe is in LOW QC.
PROBE IN MID QC ?	QC Now routine - Checks that probe is in MID QC.
PROBE IN SAMPLE ?	Analyze Blood and Analyze Urine routines - Checks that probe is in sample. Also displayed during autosampler operation when measuring a stat sample.
PROBE IN SOLN C ?	Power Up and Depro/Condition routines - Checks that probe is in Conditioner (or disinfectant).
PROBE IN SOLN D ?	Depro/Condition routine - Checks that probe is in Deproteinizer (or disinfectant).
PROBE IN TEST SOLN ?	System Test routine - Checks that probe is in electrode output test solution.
PROBE IN UR. SLOPE ?	Operating menu - Checks that probe is in urine slope.
PROBE OVER CAL ?	Autosampler message - Refer to Appendix C.
QC NOW ?	Check/Service menu and, if enabled, during any of the three daily QC prompts - Allows QC measurements.
REMOVE STAT SAMPLE	Autosampler message - Refer to Appendix C.
RESTART SYSTEM ?	Check/Service menu - Allows instrument to be restarted after System Stop.
RETURN PROBE	Operating and Check/Service menus - Instruction to lower probe when sampling is complete or if measurement is interrupted. Tone will sound if probe is not lowered within 10 seconds.
RETURN TO SET-UP ?	Check/Service menu - Allows previously selected options to be changed. If SECURITY ON ? was selected, the security key must be fitted to the data output socket to allow access to some of the Set-Up routines, see NOTE 8.
SAMPLE NOT DETECTED	Operating and Check/Service menus - Displayed for two consecutive sampling failures. Fault is flagged on the printer. May also be displayed during autosampler operation, refer Appendix C.

SAMPLE REPOSITIONED?	Operating menu - Checks that samples have been correctly repositioned, using the pump rotor, after a bubble has been detected.
SAMPLE TRAY LOADED ?	Autosampler message - Refer to Appendix C.
SAMPLER FAILED	Autosampler message - Refer to Appendix C.
SAMPLER OFF ?	Autosampler message - Refer to Appendix C.
SAMPLER RESTART ?	Autosampler message - Refer to Appendix C.
SAMPLING	Operating and Check/Service menus - Displayed alternately with SAMPLING - WAIT when solution is being aspirated.
SAMPLING FAULT	Operating and Check/Service menus - Displayed for third consecutive sampling failure, or alternates with CALIBRATING or MEASURING SLOPE. Fault is flagged on the printer.
SAMPLING - WAIT	Operating and Check/Service menus - Displayed alternately with SAMPLING when solution is being aspirated.
SAMP&SLOPE DILUTED ?	Analyze Urine routine - Reminder that urine analyses require a 1 in 10 dilution of slope and samples.
SECURITY ON ?	Power Up routine and Set-Up menu - Allows use of security key to be selected. If selected, certain routines in the Set-Up menu will only be accessible when the security key is fitted to the data output socket (see NOTE 8).
SELECT ANALYTES ?	Power Up routine - Allows selection of Na^+ only, K^+ only or Na^+ and K^+ mode.
SELECT OFF LINE	Autosampler message - Refer to Appendix C.
SERVICE REAGENTS ?	Check/Service menu - Selects calibrant maintenance routines.
SET DATE/TIME ?	Power Up routine - Allows date and time to be set.
SET HIGH QC LIMITS ?	Power Up and Change QC Limits routines - Allows minimum and maximum values for HI level of quality control sera to be set.
SET LOW QC LIMITS ?	Power Up and Change QC Limits routines - Allows minimum and maximum values for LOW level of quality control sera to be set.
SET MID QC LIMITS ?	Power Up and Change QC Limits routines - Allows minimum and maximum values for MID level of quality control sera to be set.
SET QC LIMITS ?	Power Up and Change QC Limits routines - Allows minimum and maximum values for LOW, MID and HI levels of quality control sera to be set.
SET QC PROMPTS ?	Power Up routine - Allows three daily QC prompt times to be set.
SET REF RANGES ?	Power Up and Change Ref Ranges routines - Allows acceptable ranges for blood, serum, and plasma sample measurements to be set.
SET 1st QC PROMPT ?	Power Up and Change QC Prompt routines - Allows 1st QC prompt time to be set.
SET 2nd QC PROMPT ?	Power Up and Change QC Prompt routines - Allows 2nd QC prompt time to be set.
SET 3rd QC PROMPT ?	Power Up and Change QC Prompt routines - Allows 3rd QC prompt time to be set.
SLOPE FAILED-REPEAT?	Operating and Check/Service menus - Repeats cal and slope measurement following failed slope result.
SLOPE OK	Operating and Check/Service menus - Slope results within specification. Message alternates with Na=110 K=8.00 mmol/L.

SLOPE to YEAR

SLOPE OUT OF RANGE	Operating and Check/Service menus - Displayed if slope result is out of range. Message alternates with MEASURING SLOPE.
SLOPE UNSTABLE	Operating and Check/Service menus - Displayed if slope result is unstable. Message alternates with MEASURING SLOPE.
SPRACHE = DEUTSCH ?	Power Up and Change Language routines - Selects German for alphanumeric display.
STANDARDIZE ?	Operating menu - Allows manually initiated standardizations.
STAT NEXT	Autosampler message - Refer to Appendix C.
STAT SAMPLE(>150uL)?	Autosampler message - Refer to Appendix C.
STD MODE=AUTOMATIC ?	Power Up and Change Std Mode routines - Selects automatic standardization mode of operation i.e. the time interval between calibrations is calculated to minimize drift, and will be between 10 and 60 minutes. Slope measurement is carried out every fourth calibration.
STD MODE=MANUAL ?	Power Up and Change Std Mode routines - Selects manual standardization mode of operation. In this mode the 614 checks if calibration/standardization is required before allowing sample or QC measurements.
STOP NEXT	Autosampler message - Refer to Appendix C.
SYSTEM STOP ?	Check/Service menu - Suspends instrument functions to allow routine maintenance to be performed without disconnecting power supply.
SYSTEM TEST ?	Check/Service menu - Allows instrument systems to be checked.
TESTING	System Test routine - Displayed during A/D and D/A tests.
TIME = 7:00 ?	Change Date/Time routine - Final check of time selected.
URINE ANALYSIS ?	Operating menu - Selects urine analysis mode when 614 is in ANALYZE BLOOD ? mode.
URINE SLOPE ?	Operating menu - Allows urine slope to be measured.
URINE SLOPE OK	Operating menu - Urine slope results within specification. Message alternates with Na=100 K=120 mmol/L.
UR. SLP NOT DETECTED	Operating and Check/Service menus - Displayed for two consecutive sampling failures. Fault is flagged on the printer.
WAIT - DRAINING	Check/Service menu - Instruction to wait while hydraulic system is drained.
WAIT - PRIMING	Check/Service menu - Instruction to wait while hydraulic system is primed.
WAIT 5:00 MINS	Power Up and Depro/Condition routines - Displayed during deproteinizing (or disinfection) and conditioning procedures. Message alternates with DEPROTEINIZING or CONDITIONING. Countdown duration is 5 minutes.
YEAR = 1986 ?	Change Date/Time routine - Selects year.

1 POINT (CAL) ?	Operating menu - Allows 1 point calibration to be performed.
2 POINT (CAL+SLOPE)?	Operating menu - Allows 2 point calibration to be performed.
2PT (CAL+SLOPE) DUE	Autosampler message - Refer to Appendix C.
1st PROMPT AT 8:00?	Change QC Prompt routine - Final check of time selected for 1st QC prompt.
2nd PROMPT AT 10:00?	Change QC Prompt routine - Final check of time selected for 2nd QC prompt.
3rd PROMPT AT 12:00?	Change QC Prompt routine - Final check of time selected for 3rd QC prompt.
####################	Power Up and System Test routines - Part of disp/printer test. During System Test the display is frozen for 10 seconds and the message is printed. To continue before the 10 seconds has elapsed, press yes or no.
!!!!!!!!!!!!!!!!!!!!	Power Up routine - Abnormality detected during self diagnostic test. Contact Ciba Corning.

NOTES

1. The integral printer will print out all the parameters selected during the Power Up routine or during any subsequent change using the Set-Up menu, regardless of the printer option selected.

2. Results which are outside preset limits will only be flagged on the printer if both the relevant limits and the printer are enabled.

3. The 614 will default to ANALYZE BLOOD ? from every Operating menu routine, all the Set-Up menu routines and from certain Check/Service menu routines.

4. During the Power Up procedure there is an opportunity to enter each routine in the Set-Up menu to select other than default values. For example, if yes is pressed to SET REF RANGES ? all the messages that appear in the Change Ref Ranges routine (Set-Up menu) could be displayed.

5. In automatic mode the user can initiate sampling by raising the probe instead of pressing yes. This will also bypass the OPEN PROBE message.

6. If an overrange or underrange error is present on the Na^+ channel only, asterisks replace the Na^+ result for sample and QC measurements. If errors are present on both channels, the Na^+ error message will alternate with K OVER RANGE, K UNSTABLE or K UNDER RANGE.

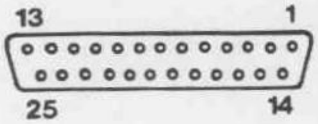
7. If an overrange or underrange error is present on the K^+ channel only, asterisks replace the K^+ result for sample and QC measurements. If errors are present on both channels, the K^+ error message will alternate with Na OVER RANGE, Na UNSTABLE or Na UNDER RANGE.

8. If SECURITY ON ? is selected, the security key must be fitted to the data output socket to access the following routines: CHANGE QC LIMITS ?, CHANGE QC PROMPT ?, CHANGE REF RANGES ?, CHANGE SLOPE/INTCPT?, CHANGE DMS OPTION?, CHANGE LANGUAGE ? and CHANGE SECURITY ?.

Data Transfer Specification

Figure FB1 Data Output Chart

data output



The 614 can interface with a Ciba Corning 101 or 102 printer, Axiom™ printer, as well as other 20 mA current loop and RS232C compatible devices.

Pin	Signal	Pin	Signal
1	protective ground	11	20 mA Rx +ve
2	RS232 Tx	12 & 13	not used
3	RS232 Rx	14	+12V
4 & 5	not used	15 to 17	not used
6	security link	18	-12V
7	RS232 OV	19 to 23	not used
8	20 mA Tx -ve	24	security link
9	20 mA Tx +ve	25	+5V
10	20 mA Rx -ve		

Mode A

Selection of mode A will allow connection of a unidirectional printer (Axiom EX 801) to the data output port. The data output will be identical to the data printed on the instrument's integral printer. The information will still be present at the port even when the integral printer is disabled.

Type of communication - Unidirectional
Baud rate - 300
Data format - 1 start bit
7 data bits
2 stop bits
Parity on
Parity even

Mode B

Selection of mode B will allow connection of bidirectional computers (CC III and other Ciba Corning data management systems).

All data output will be in English irrespective of language selected on the 614.

Type of communication - Bidirectional
Baud rate - 7200
Data format - 1 start bit
7 data bits
2 stop bits
Parity on
Parity even

TM Axiom Corp., 5923 San Fernando Road, Glendale, California 91202, USA

Data Transfer Specification (cont)

Mode C

Selection of mode C will allow connection of bidirectional printers (Ciba Corning 101 and 102 printers).

All data output will be in English irrespective of language selected on the 614.

Type of communication - Bidirectional
Baud rate - 1200
Data format - 1 start bit
7 data bits
2 stop bits
Parity on
Parity even

Control Code Interaction

a) When instrument starts to display MEASURING, PLEASE WAIT during the ANALYZE ? cycle:
DC1 - ETX is transmitted
Response to BELL and BS is inhibited

When sample measurement is complete or yes is pressed to LAST RESULT RECALL ?:

DC2 - ETX is transmitted
Response to BELL and BS is enabled
The instrument waits for ACK, BELL or BS until another cycle is initiated.

b) When yes is pressed to 1 POINT (CAL) ? or 2 POINT (CAL+SLOPE)?:
Response to BELL and BS is inhibited

When the 1 or 2 point standardization is complete:

DC3 - ETX is transmitted
Response to BELL and BS is enabled
The instrument waits for ACK, BELL or BS until another cycle is initiated.

c) Instrument response to ACK received:
Transmits

6	1	4	CR	LF	ETX

Instrument responds to ACK at any time.

d) Instrument response to BELL received:
Transmits sample data (see Table 1)
Instrument responds only if a sample/calibration cycle is not in progress.

Data Transfer Specification (cont)

Table 1 Sample Data Format

Line No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	CR	LF																	
2	S	A	M	P	L	E						M	M	O	L	/	L	CR	LF
3									N	A					X	X	X	CR	LF
4										K				X	.	X	X	CR	LF
5	LF	ETX																	

If result is unstable or out of range, character no. 11 in line 3 or 4 (depending on which parameter is at fault) will be *

If result is unstable the measured result will be printed.

Alternatively character nos. 15, 16 and 17 will be: E15 - underrange
E16 - overrange

e) Instrument response to BS received:
Transmits cal/slope data (see Table 2)
Instrument responds only if a sample/calibration cycle is not in progress.

Table 2 Cal/Slope Data Format

Line No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
1	CR	LF																																
*2	C	A	L													M	M	O	L	/	L						M	M	O	L	/	L	CR	LF
3									N	A			O	L	D				X	X	X			N	E	W				X	X	X	CR	LF
4										K			O	L	D			X	.	X	X			N	E	W			X	.	X	X	CR	LF
5	LF	ETX																																

* For a 2 point calibration this will be 'slope' in characters 1 to 5.

If result is unstable or out of range, character no. 11 in line 3 or 4 (depending on which parameter is at fault) will be *

If unstable, old and new results will be measured result.
Alternatively, error code will be in 19, 20, 21 and 30, 31, 32 of appropriate line
E12 - cal out of range
E13 - slope out of 'pull-in' range.

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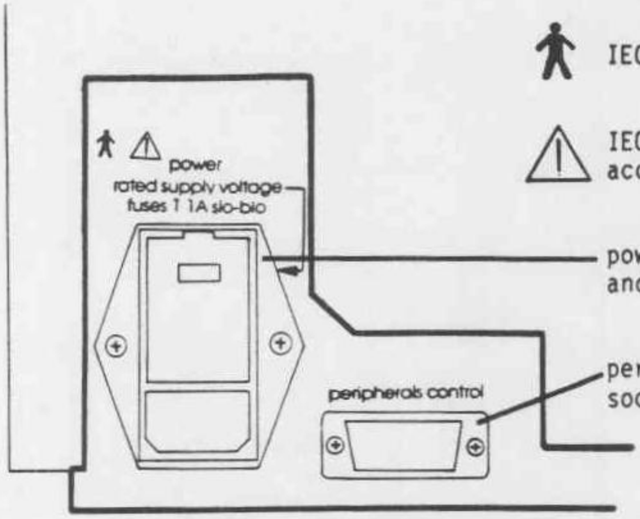
C1.1 Installation – The Rear Panel – Selecting Voltage

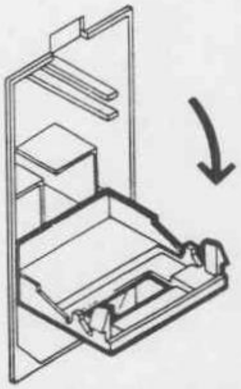

power
rated supply voltage
fuses T 1A slo-blo
peripherals control

🯅 IEC symbol denoting Type B equipment

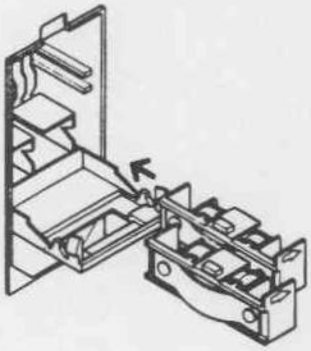
⚠ IEC symbol advising user to refer to accompanying documentation

power connector, voltage selector and fuses

peripherals control, 15-way D-line socket

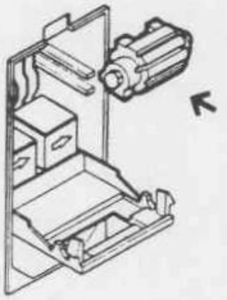


Open the voltage selector cover with the screwdriver supplied with the 614.



Insert the two fuses into the fuseholders and slide the fuseholders into the voltage selector.

C1.1 Installation - Selecting Voltage (cont)

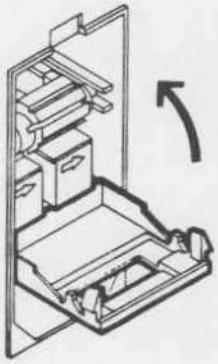


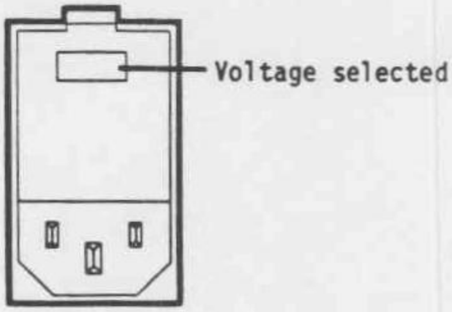
Select the voltage required for the local supply.

Voltage Selected	Voltage Range
115V	90V to 132V
230V	198V to 264V

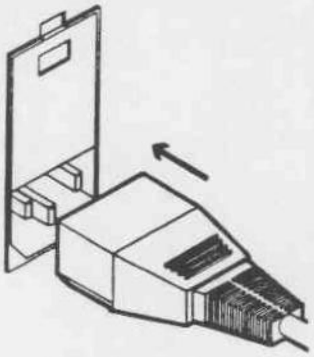
Slide the voltage selector bobbin into the voltage selector so that the selected voltage is visible when the voltage selector cover is closed.

CAUTION: Do not rotate the bobbin when it is fitted in the voltage selector as this will damage the contacts.





Close the voltage selector cover.

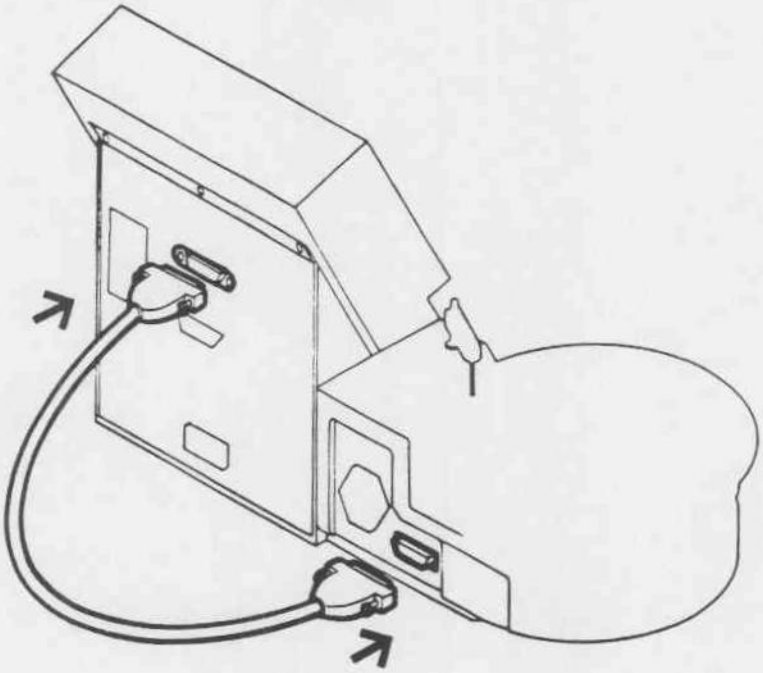


If necessary, connect a suitable plug to the line cord. Connect the line cord to the power connector on the rear panel.

NOTE: Do not connect the line cord to the power supply.

C1.1 Installation - Connecting the 604 to the 614

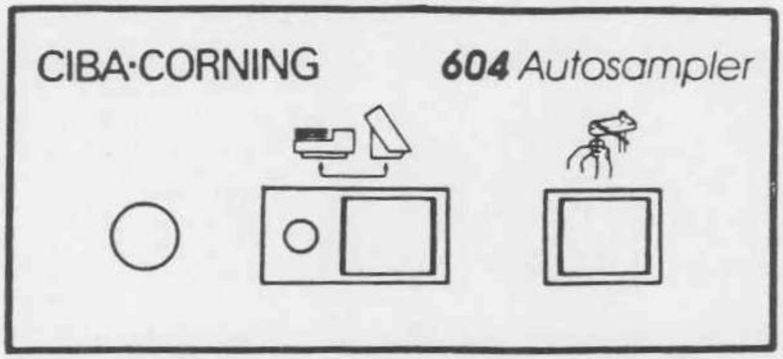
IMPORTANT: Disconnect the 614 line cord from the power supply socket. (The 614 will retain the Set-Up menu parameters for 30 minutes).



Connect the interface cable to the peripherals control on the 604 and 614, and tighten the screws.

Reconnect the 614 line cord to the power supply socket. Connect the 604 autosampler line cord to a suitable power supply socket.

C2.1 Front Panel - The Controls



power neon illuminated when 604 is connected to power supply

on line/off line control and LED

stat sample/stop control

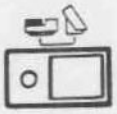
Make sure there is sufficient printer paper for the number of samples to be measured. (NOTE: During autosampler operation all results and standardizations are printed regardless of the printer options previously selected). Press ○ to reset the sample number to 1.

C2.2 Operating Instructions - To Measure Serum, Plasma and QC Samples

If the 614 is in manual standardization mode and more than 10 minutes have elapsed since the last calibration, the instrument will standardize.

ANALYZE BLOOD ?

press



▼

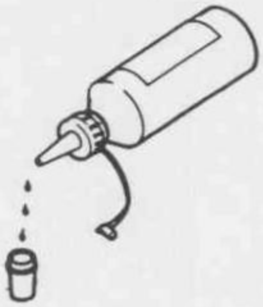
AUTOSAMPLER ?

yes

▼

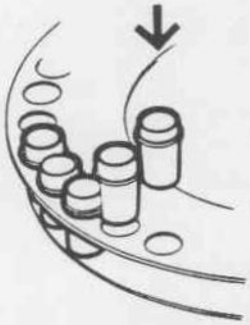
SAMPLE TRAY LOADED ?

▼



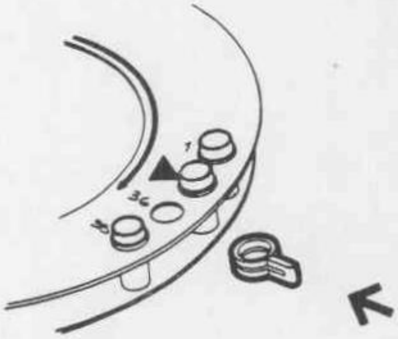
Fill the sample cups for the cal positions with 614/604 calibrating solution (Cat. 478692). Make sure each cup contains at least 250 µL of solution but do not fill cups more than 2/3 full.

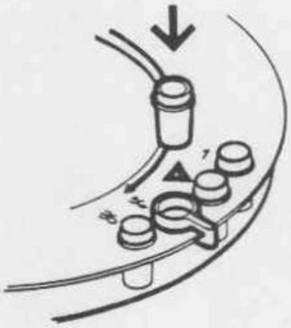
C2.2 Operating Instructions – To Measure Serum, Plasma and QC Samples (cont)



Load the sample tray with samples (make sure the cups in the cal positions contain 614/604 calibrating solution). Make sure each cup contains at least 250 µL of solution but do not fill cups more than 2/3 full.

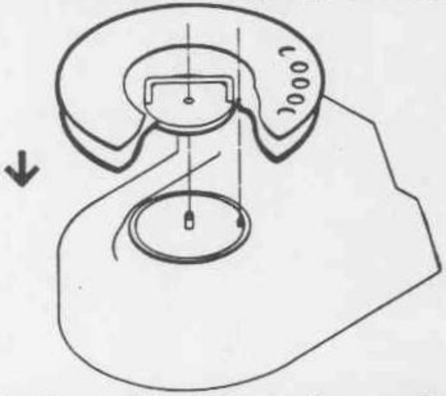
IMPORTANT: Do not attempt to measure non-urine (eg. serum, plasma, QC) and urine samples on the same run, as in `ANALYZE URINE ?` the 614 automatically corrects for the 1 in 10 dilution factor.

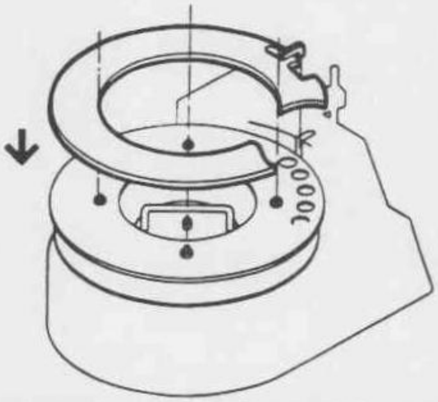




Clip the last sample flag to the sample cup in the last position.

IMPORTANT: Ciba Corning recommend that this cup contains 614/604 calibrating solution to rinse the probe and tubing.





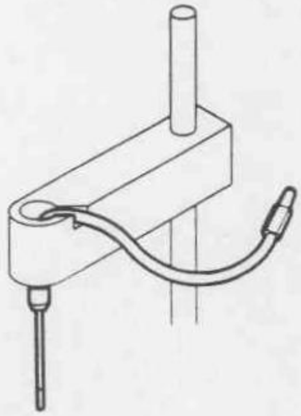
Place the sample tray on the sampler, make sure that the peg is located in the hole, and fit the cover.

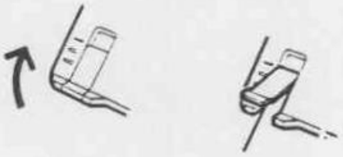
yes

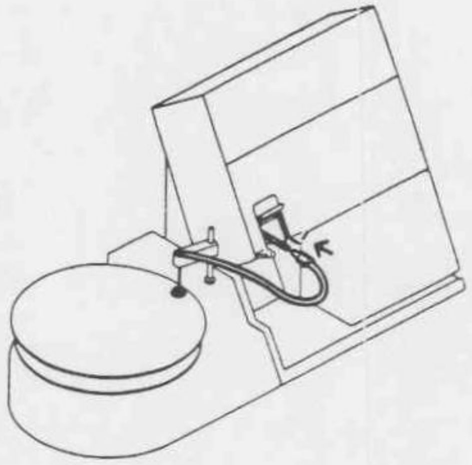
C2.2 Operating Instructions – To Measure Serum, Plasma and QC Samples (cont)

▼

CONNECT PROBE



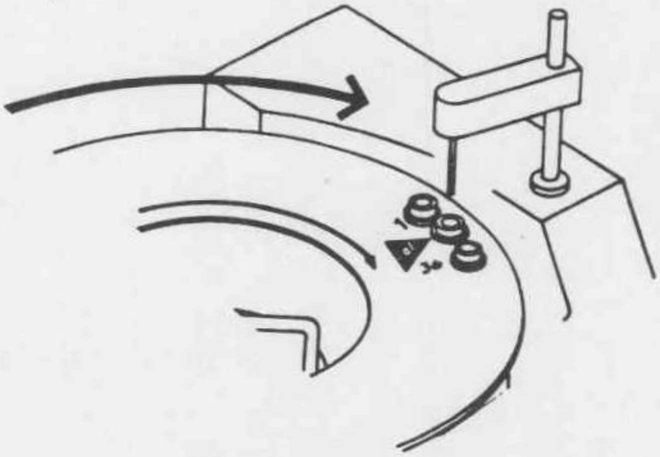




If necessary, fit the autosampler probe - make sure the tubing is fitted in the slot. Open the 614 probe to the ≡ position. Connect the autosampler probe tubing to the 614 probe.

PROBE OVER CAL ?

▼



IMPORTANT: Move the sample tray clockwise until the first cal position is below the probe.

yes

▼

AUTOSAMPLER START ?

yes

▼

NOTE: Do not close the 614 probe as the 614 will continue to operate in autosampler mode.

C2.2 Operating Instructions – To Measure Serum, Plasma and QC Samples (cont)

▼

```
SAMPLING
```

▼

```
CALIBRATING
```

▼

```
CALIBRATION OK
Na=140 K=4.00 mmol/L
```

▼

```
SAMPLING
```

▼

```
MEASURING
```

▼

```
Na=145 K=4.20 mmol/L
```

(Example result)

▼

```
SAMPLING
```

The sample tray will move to the next position, and measure the sample.

▼

```
MEASURING
```

▼

C2.2 Operating Instructions – To Measure Serum, Plasma and QC Samples (cont)

▼

Na=138 K=4.11 mmol/L

▼

(Example result)

The autosampler will repeat this sequence (calibrating after every nine samples) until the last sample flag is reached.

▼

AUTOSAMPLER START ?

no

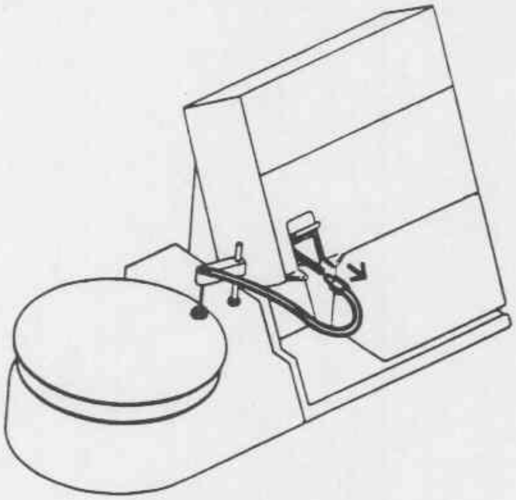
▼

To measure more samples, reload the sample tray, position the first cal under the probe and press yes
NOTE: If a 2-point calibration is due the display will read 2 PT (CAL+SLOPE) DUE and PROBE DISCONNECTED . This must be carried out before the 614 will allow autosampling to continue.

▼

PROBE DISCONNECTED ?

▼



Disconnect the autosampler probe tubing from the 614 probe.

NOTE: Check that the 614 probe is still correctly positioned as removing the autosampler probe tubing may have loosened it.

yes

▼

RETURN PROBE

▼

C2.2 Operating Instructions – To Measure Serum, Plasma and QC Samples (cont)

The 614 will standardize.

▼

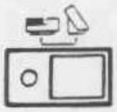
`AUTOSAMPLER ?`

no

▼

`SELECT OFF LINE`

press



▼

`ANALYZE BLOOD ?`

C2.3 Operating Instructions - To Measure a Stat Sample

Stat samples of greater than 150 µL can be measured at any time during an autosampler run in blood mode. They cannot be measured in urine mode because the 614 automatically corrects for the 1 in 10 dilution factor.

NOTE: To measure samples of less than 150 µL exit the autosampler mode by pressing ☐ STAT SAMPLE(>150uL)? (no) ► SAMPLER RESTART ?

(no)

▼

SAMPLER OFF ?

(yes)

Press ☐

The 614 will display STAT NEXT alternating with the current display

e.g. SAMPLING
STAT NEXT

The 614 will finish measuring (or calibrating) and the autosampler will stop with its probe in the raised position.

▼

STAT SAMPLE(>150uL)?

(yes)

▼

if stat/stop was pressed in ANALYZE URINE ? this message will not appear. The 614 will display

SAMPLER RESTART ? (no) ► SAMPLER OFF ?

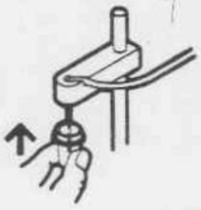
(yes)

▼

continues auto sampling

PROBE IN SAMPLE ?

(/3



(yes)

▼

IMPORTANT: Stat samples should be presented to the autosampler probe, not the 614 probe. Do not disconnect the autosampler probe tubing.

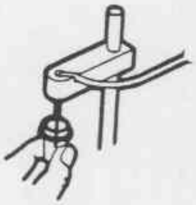
To measure stat samples of less than 150 µL, e.g. capillary samples, return the 614 to normal operation. The 614 will be ready to measure in approximately 2 minutes.

C2.3 Operating Instructions – To Measure a Stat Sample (cont)

▼

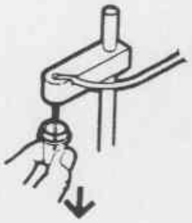
SAMPLING
SAMPLING - WAIT

▼



REMOVE STAT SAMPLE

▼



MEASURING
PLEASE WAIT

▼

Na=145 K=4.20 mmol/L

▼

(Example result - The sample number is not included in the printout of stat sample results)

STAT SAMPLE(>150uL)? yes ► ► to measure another stat sample

no
▼

SAMPLER RESTART ? no ► SAMPLER OFF ?

yes
▼

continues auto sampling

C2.4 Operating Instructions – To Measure Urine Samples

Make sure there is sufficient printer paper for the number of samples to be measured. (NOTE: During autosampler operation all results and standardizations are printed regardless of the printer options previously selected). Press ○ to reset the sample number to 1.

Ciba Corning recommend that for urine determinations:

(a) a 100 µL pipette is used, as specified in Section 11.2.

(b) 2 mL (nominal) sample cups with caps are used.

(c) the Urine Starter Pack (Cat. 478626, refer to Section C6.2) is used.

(d) for Na^+/K^+ analysis on the 614 urine must not be collected into a strong acid preservative.

1. Refer to the manufacturer's manual supplied with the dispenser and set the volume to 900 µL (0.9 mL).
2. Pipette 100 µL of Urine Slope Standard into a 2 mL sample cup. Add 900 µL of Urine Diluent, using the Ciba Corning diluent dispenser, and cap the sample cup.

IMPORTANT: Do not dilute the 614/604 calibrating solution.

3. Pipette 100 µL of sample into another 2 mL sample cup, add 900 µL of Urine Diluent and cap. Repeat for other samples.

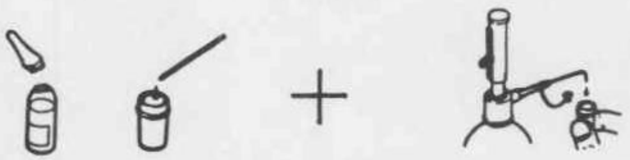
CAUTION: Do not leave the solutions exposed to atmosphere, cap immediately, as evaporation will cause an increase in Na^+ and K^+ concentration.

4. Mix the standard and samples by inversion.

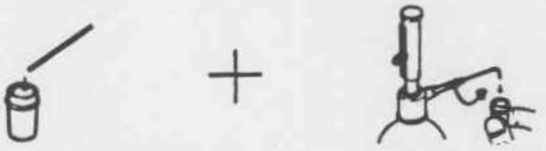
URINE ANALYSIS ?

yes

SAMP&SLOPE DILUTED ?



100 µL of Urine Slope + 900 µL of Urine Diluent



100 µL of Urine Sample + 900 µL of Urine Diluent

yes

C2.4 Operating Instructions – To Measure Urine Samples (cont)

▼

CALIBRATING
PLEASE WAIT

▼

If more than 10 minutes have elapsed since the last calibration the 614 will calibrate.

CALIBRATION OK
Na=140 K=4.00 mmol/L

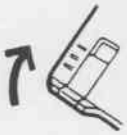
▼

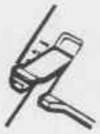
URINE SLOPE ?

yes

▼

OPEN PROBE

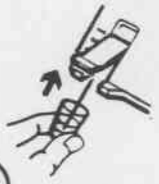




▼

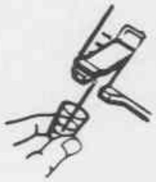
PROBE IN UR. SLOPE ?

▼



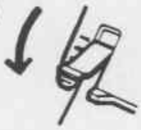
yes

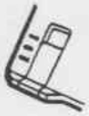
SAMPLING
SAMPLING - WAIT



▼

RETURN PROBE





▼

(If the probe is not returned within 10 seconds the tone will sound).

MEASURING UR. SLOPE
PLEASE WAIT

▼

C2.4 Operating Instructions - To Measure Urine Samples (cont)

▼

URINE SLOPE OK
Na=100 K=120 mmol/L

▼

ANALYZE URINE ?

press

▼

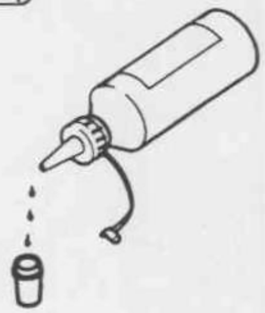
AUTOSAMPLER ?

yes

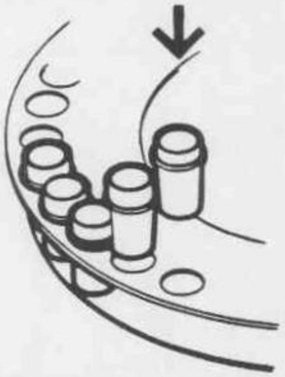
▼

SAMPLE TRAY LOADED ?

▼



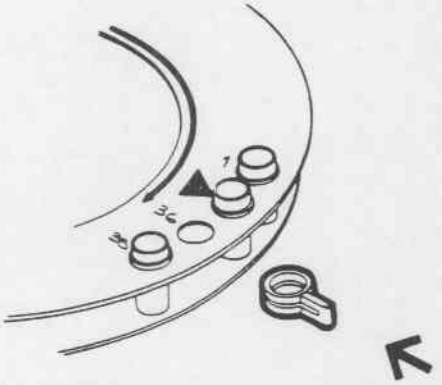
Fill the sample cups for the cal positions with 614/604 calibrating solution (Cat. 478692). Make sure each cup contains at least 600 µL of solution but do not fill cups more than 2/3 full.

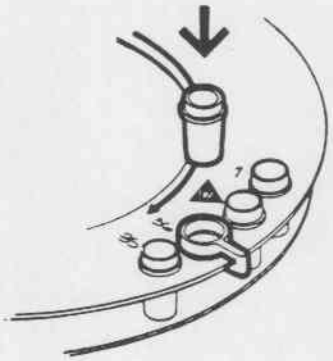


Load the sample tray with pre-diluted samples (make sure the cups in the cal positions contain undiluted 614/604 calibrating solution). Make sure each cup contains at least 600 µL of solution but do not fill cups more than 2/3 full. Remove the caps from the sample cups.

C2.4 Operating Instructions – To Measure Urine Samples (cont)

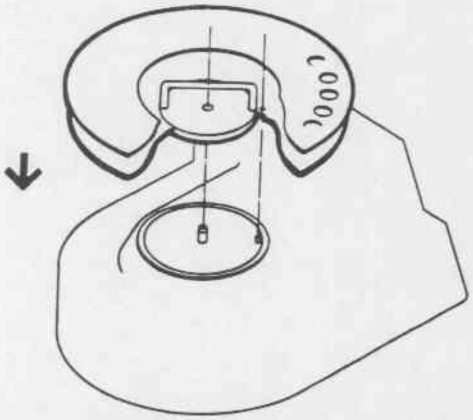
IMPORTANT: Do not attempt to measure urine and non-urine (eg. serum, plasma, QC) samples on the same run, as in (ANALYZE URINE ?) the 614 automatically corrects for the 1 in 10 dilution factor.

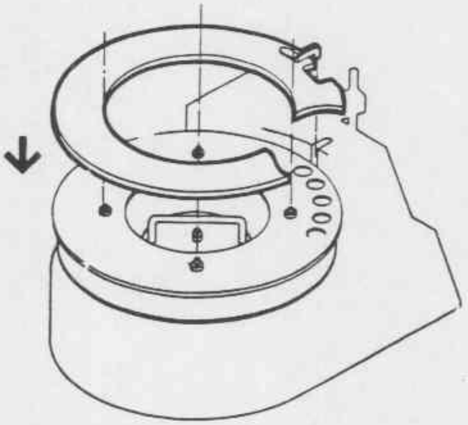




Clip the last sample flag to the sample cup in the last position.

IMPORTANT: Ciba Corning recommend that this cup contains 614/604 calibrating solution to rinse the probe and tubing.





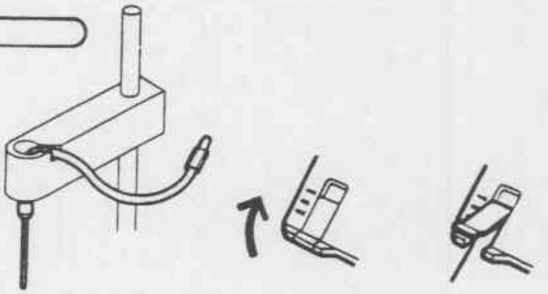
Place the sample tray on the sampler, make sure that the peg is located in the hole, and fit the cover.

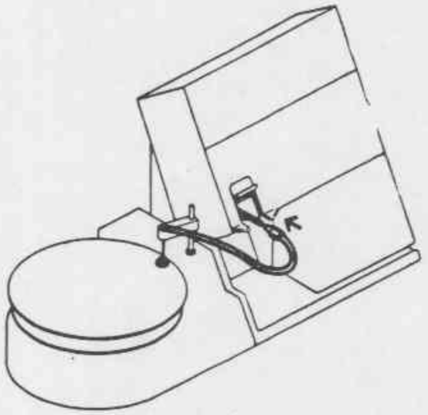
(yes)

▼

(CONNECT PROBE)

▼



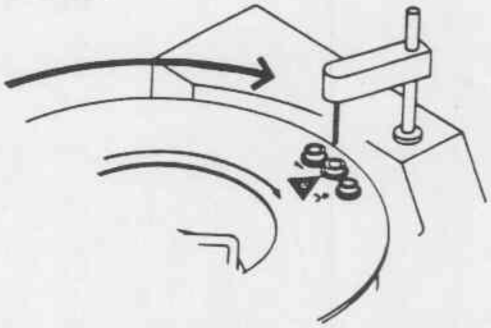


C2.4 Operating Instructions – To Measure Urine Samples (cont)

If necessary, fit the autosampler probe - make sure the tubing is fitted in the slot. Open the 614 probe to the ═══≡ position. Connect the autosampler probe tubing to the 614 probe.

PROBE OVER CAL ?

▼



IMPORTANT: Move the sample tray clockwise until the first cal position is below the probe.

yes

▼

AUTOSAMPLER START ?

NOTE: Do not close the 614 probe as the 614 will continue to operate in autosampler mode.

yes

▼

SAMPLING

▼

CALIBRATING

▼

CALIBRATION OK
Na=140 K=4.00 mmol/l

▼

SAMPLING

▼

C2.4 Operating Instructions – To Measure Urine Samples (cont)

▼

(MEASURING)

▼

(Na=50 K=60 mmol/L)

(Example urine result)

▼

(SAMPLING)

The sample tray will move to the next position, and measure the sample.

▼

(MEASURING)

▼

(Na=102 K=39 mmol/L)

(Example urine result)

The autosampler will repeat this sequence (calibrating after every nine samples) until the last sample flag is reached.

▼

(AUTOSAMPLER START ?)

no

▼

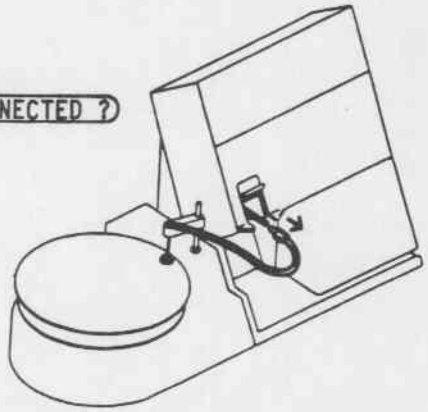
To measure more samples, reload the sample tray, position the first cal under the probe and press yes

NOTE: If the autosampler has been operating for more than 4 hours, Ciba Corning recommend that the 614 is returned to normal operation and a 2-point calibration carried out.

▼

(PROBE DISCONNECTED ?)

▼



C2.4 Operating Instructions – To Measure Urine Samples (cont)

Disconnect the autosampler probe tubing from the 614 probe.

NOTE: Check that the 614 probe is still correctly positioned as removing the autosampler probe tubing may have loosened it.

yes

▼

RETURN PROBE

▼

The 614 will standardize.

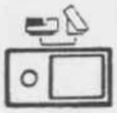
▼

AUTOSAMPLER ?

no

▼

SELECT OFF LINE

press 

▼

ANALYZE URINE ?

C3.1 Operating Precautions and Hazards

1. Do not fill sample cups more than 2/3 full, otherwise spillages and cross contamination may occur.

2. Do not measure whole blood samples on the autosampler.

3. Do not use flame photometer standards with the 604 as they contain viscosity compensation agents that will damage the 614 electrodes.

4. Some QC materials contain substances which are known to damage electrodes, or affect electrode response. Do not use any QC material containing ethylene glycol, caesium ions or excessive amounts of ammonium ions.

5. Make sure that only Ciba Corning reagents and supplies are used with the 604. Always use 614/604 calibrating solution as the volume and the dispenser have been chosen for ease of use. Do not use solutions after the expiration date shown on the label. Do not decant solutions from one bottle to another as this can cause contamination.

6. Make sure that routine maintenance is carried out as stated in the Maintenance Section.

7. The maximum non-destructive voltage that can be applied to the peripherals control socket is +5V d.c.

8. There are no user replaceable parts within the instrument. Do not remove the cover from the 604.

9. All samples should be treated with the caution accorded to those known to contain pathogenic organisms.

C4.1 Weekly Maintenance

The 604 is simple to maintain. Follow these procedures to keep the autosampler in good working order.

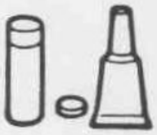
Equipment
2% activated glutaraldehyde solution (e.g. CIDEX™); clean tissues;
Deproteinizer (D) solution, Cat. 478700.

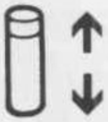
NOTE: Do not add other decontaminants, e.g. hypochlorite, to the glutaraldehyde solution.

The 604 autosampler should be wiped regularly with clean tissues moistened with 2% activated glutaraldehyde solution.

Once a week the autosampler probe and tubing should be disinfected and deproteinized.

NOTE: Activate the Deproteinizer with a pepsin tablet before starting this procedure as the tablet will take between 10 and 15 minutes to dissolve.





Cap and shake the vial until the pepsin tablet has dissolved, or leave to stand for 15 minutes. The pepsin tablet must be completely dissolved before use. Dispense the solution equally into three sample cups. Dispense 2% activated glutaraldehyde solution into another three sample cups.

ANALYZE BLOOD ?

press

▼

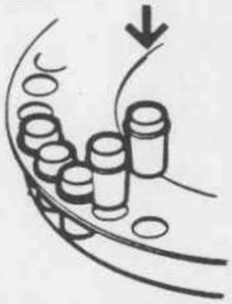
AUTOSAMPLER ?

yes

▼

SAMPLE TRAY LOADED ?

▼

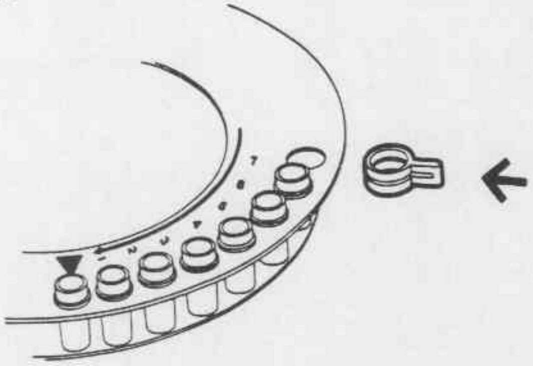


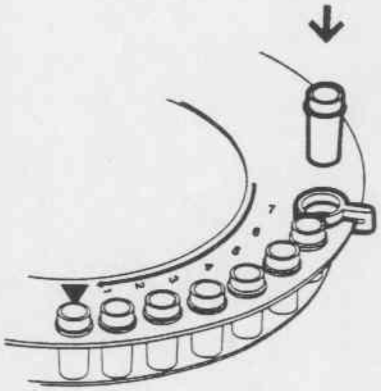
If the 614 is in manual standardization mode and more than 10 minutes have elapsed since the last calibration, the instrument will standardize when is pressed.

TM Surgikos Ltd., Livingston, Scotland.

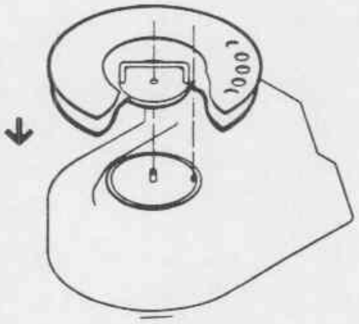
C4.1 Weekly Maintenance (cont)

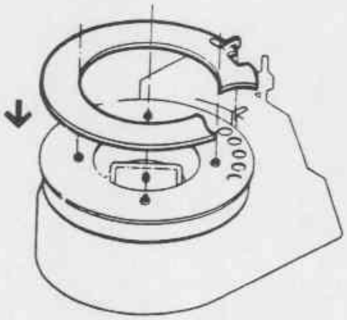
Load the sample tray with 614/604 calibrating solution in the first cal position; 2% activated glutaraldehyde solution in positions 1, 2 and 3; activated Deproteinizer in positions 4, 5 and 6, and calibrating solution in position 7 to rinse the probe and tubing.





Clip the last sample flag to the sample cup in the last position.





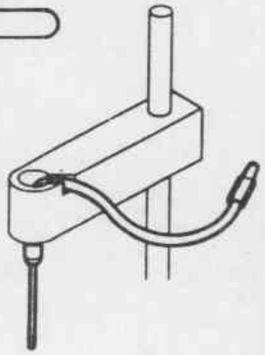
Place the sample tray on the sampler, make sure that the peg is located in the hole, and fit the cover.

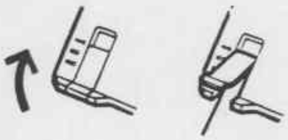
yes

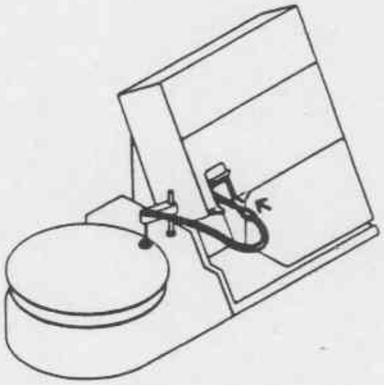
▼

CONNECT PROBE

▼







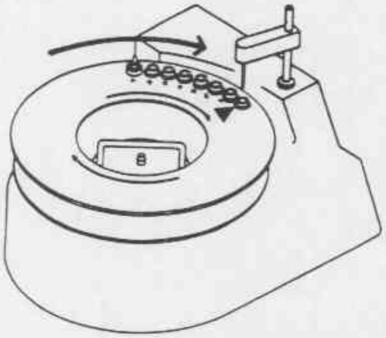
If necessary, fit the autosampler probe - make sure the tubing is fitted in the slot. Open the 614 probe to the ══≡ position. Connect the autosampler probe tubing to the 614 probe.

C4.1 Weekly Maintenance (cont)

▼

`PROBE OVER CAL ?`

▼



IMPORTANT: Move the sample tray clockwise until the first cal position is below the probe.

yes

▼

`AUTOSAMPLER START ?`

yes

▼

`SAMPLING`

▼

`CALIBRATING`

▼

`CALIBRATION OK`
`Na=140 K=4.00 mmol/L`

▼

`SAMPLING`

▼

C4.1 Weekly Maintenance (cont)

▼

MEASURING

▼

Na=XXX K=X.XX mmol/L

(Example result)

▼

SAMPLING

The sample tray will move to the next position.

▼

MEASURING

▼

Na=XXX K=X.XX mmol/L

(Example result)

▼

The autosampler will repeat this sequence until the last sample flag is reached.

▼

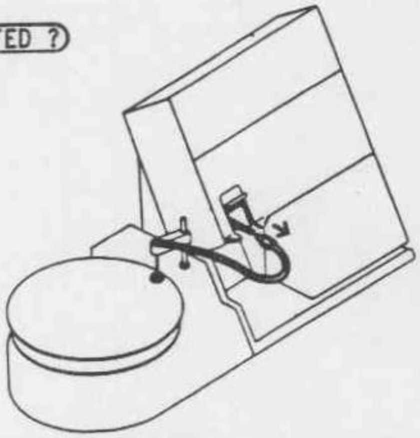
AUTOSAMPLER START ?

no

▼

PROBE DISCONNECTED ?

▼



Disconnect the autosampler probe tubing from the 614 probe.

C4.1 Weekly Maintenance (cont)

NOTE: Check that the 614 probe is still correctly positioned as removing the autosampler probe tubing may have loosened it.

(yes)

▼

`RETURN PROBE`

▼

The 614 will standardize.

▼

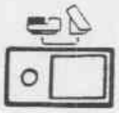
`AUTOSAMPLER ?`

(no)

▼

`SELECT OFF LINE`

press

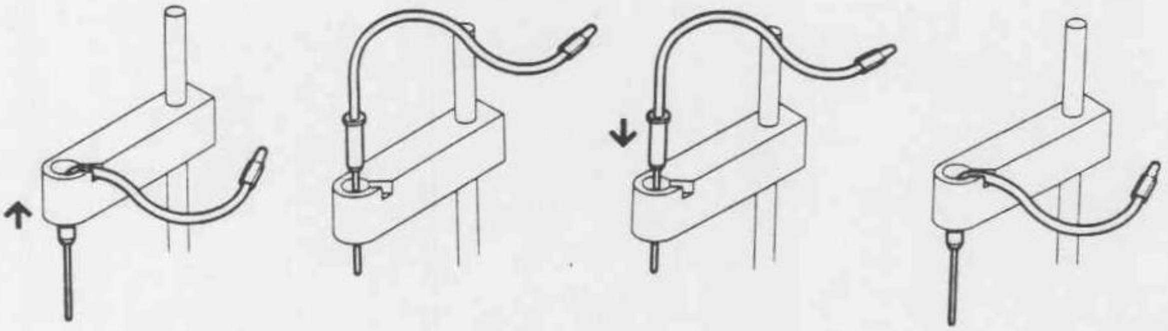


▼

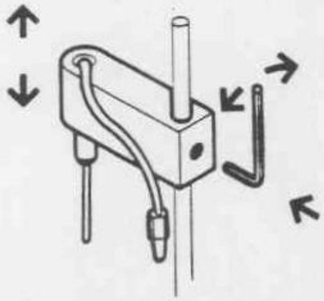
`ANALYZE BLOOD ?`

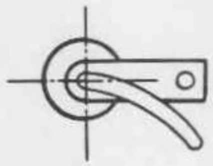
IMPORTANT: Ciba Corning recommend that once a week the autosampler probe and tubing is removed and immersed in 2% activated glutaraldehyde solution for 10 minutes.

Equipment
Autosampler probe and tubing kit, Cat. 478621; Hex key, supplied.



Make sure the tubing is fitted in the slot.



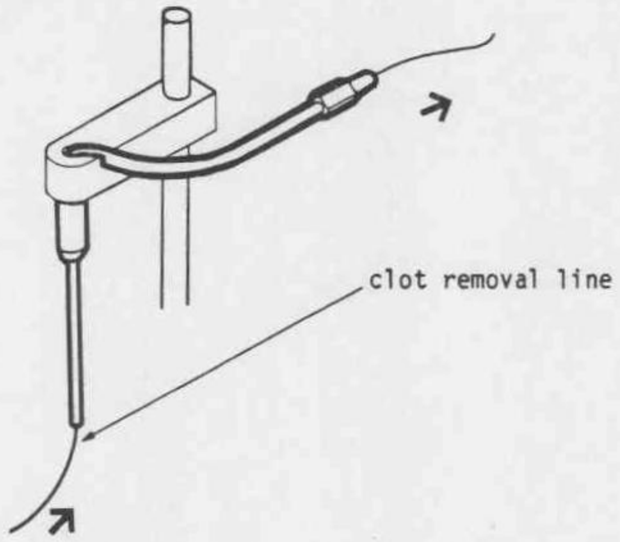


The height of the probe should be approximately 3 mm above the bottom of the sample cup so that the probe does not touch the bottom when the autosampler is aspirating. The probe should also be positioned centrally over the sample cup. Make sure the hex screw is tightened.

C4.3 Maintenance - To Clear Blockages

Equipment
Clot removal line, Cat. 478645

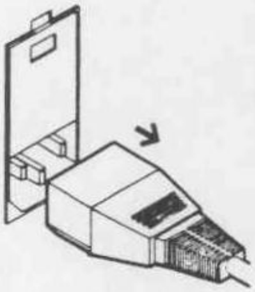
WARNING: Always wear protective gloves when carrying out this procedure.

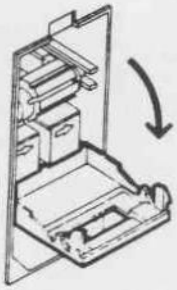


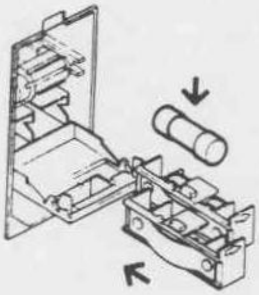
C4.4 Maintenance - To Replace a Fuse

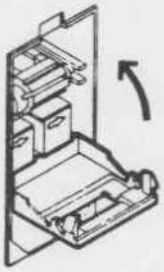
Equipment
Fuses, Cat. 478648.

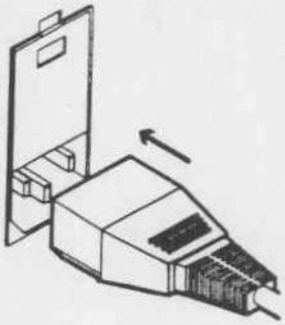
WARNING: For continued protection against fire hazard use only the same type and rating of fuse that was fitted originally to the 604 - refer to instrument rear panel.











Make sure that the voltage bobbin is set to the correct voltage for the local power supply.

Voltage Selected	Voltage Range
115V	90V to 132V
230V	198V to 264V

CAUTION: Do not rotate the voltage selector bobbin when it is fitted in the voltage selector as this will damage the contacts.

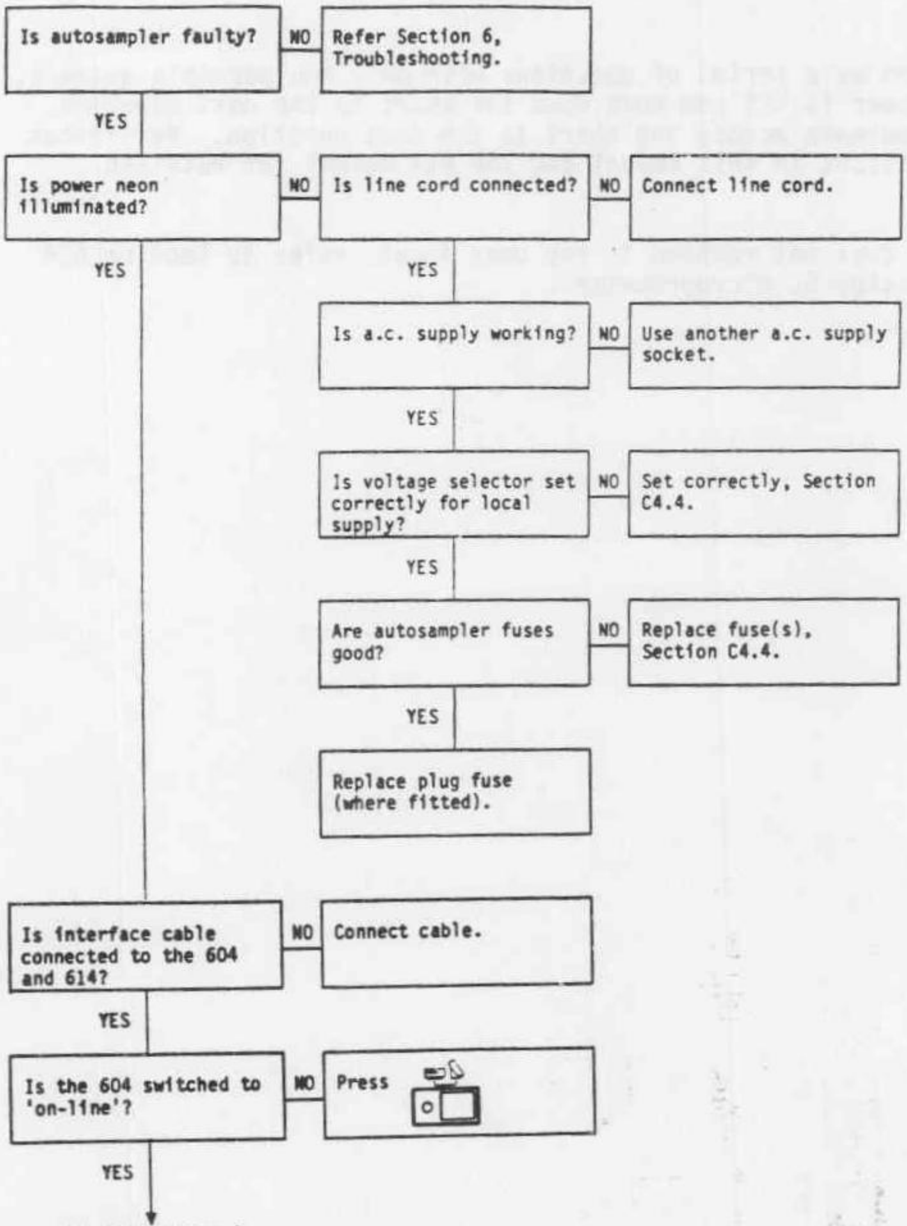
C5.1 Troubleshooting

The Troubleshooting Charts are intended to help users clear faults as quickly as possible.

The charts are arranged as a series of questions with only two possible answers, YES or NO. If the answer is YES you move down the chart to the next question. If the answer is NO you move across the chart to the next question. References are given to other sections in this manual and the 614 manual for detailed information.

NOTE: If the 614/604 does not respond to any user input, refer to Section 6.4 and check Status Indicator 5, microprocessor.

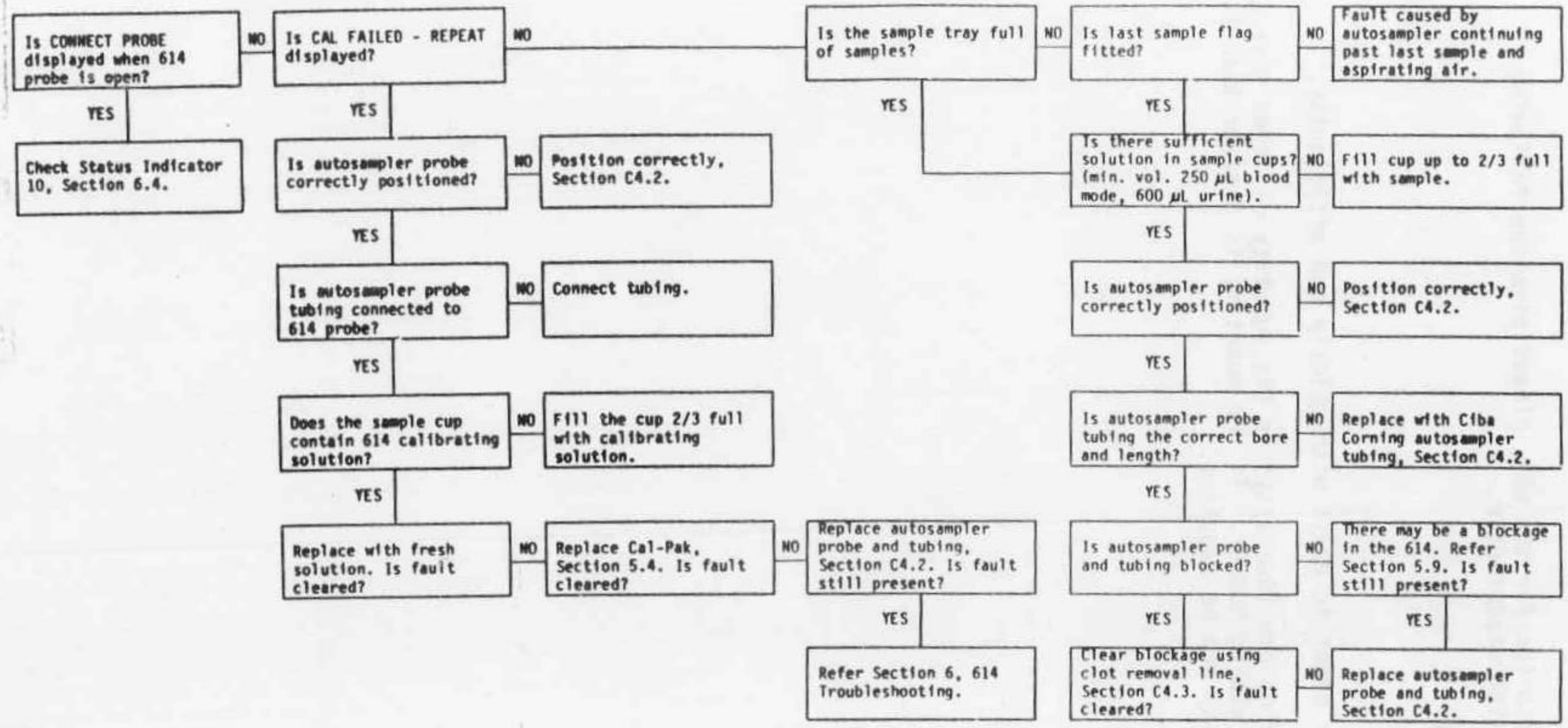
C5.2 Troubleshooting Chart 8


Is autosampler faulty?
NO
Refer Section 6, Troubleshooting.
YES
Is power neon illuminated?
NO
Is line cord connected?
NO
Connect line cord.
YES
YES
Is a.c. supply working?
NO
Use another a.c. supply socket.
YES
Is voltage selector set correctly for local supply?
NO
Set correctly, Section C4.4.
YES
Are autosampler fuses good?
NO
Replace fuse(s), Section C4.4.
YES
Replace plug fuse (where fitted).
Is interface cable connected to the 604 and 614?
NO
Connect cable.
YES
Is the 604 switched to 'on-line'?
NO
Press
YES

continue with Chart 9

IF FAULT PERSISTS CONTACT CIBA CORNING OR DISTRIBUTOR

C5.2 Troubleshooting Chart 9


Is CONNECT PROBE displayed when 614 probe is open?
YES
Check Status Indicator 10, Section 6.4.
NO
Is CAL FAILED - REPEAT displayed?
YES
Is autosampler probe correctly positioned?
NO
Position correctly, Section C4.2.
YES
Is autosampler probe tubing connected to 614 probe?
NO
Connect tubing.
YES
Does the sample cup contain 614 calibrating solution?
NO
Fill the cup 2/3 full with calibrating solution.
YES
Replace with fresh solution. Is fault cleared?
NO
Replace Cal-Pak, Section 5.4. Is fault cleared?
NO
Replace autosampler probe and tubing, Section C4.2. Is fault still present?
YES
Refer Section 6, 614 Troubleshooting.
NO
Is the sample tray full of samples?
YES
NO
Is last sample flag fitted?
NO
Fault caused by autosampler continuing past last sample and aspirating air.
YES
Is there sufficient solution in sample cups? (min. vol. 250 µL blood mode, 600 µL urine).
NO
Fill cup up to 2/3 full with sample.
YES
Is autosampler probe correctly positioned?
NO
Position correctly, Section C4.2.
YES
Is autosampler probe tubing the correct bore and length?
NO
Replace with Ciba Corning autosampler tubing, Section C4.2.
YES
Is autosampler probe and tubing blocked?
NO
There may be a blockage in the 614. Refer Section 5.9. Is fault still present?
YES
Replace autosampler probe and tubing, Section C4.2.
YES
Clear blockage using clot removal line, Section C4.3. Is fault cleared?
NO

IF FAULT PERSISTS
CONTACT CIBA CORNING OR
DISTRIBUTOR

C6.1 Ordering Information

When ordering spares or accessories for the 604, please give the following information to your Ciba Corning distributor.
604 Serial Number
Catalog Number of Part (Cat.)
Description
Quantity Required

This will make sure that your order is dealt with quickly and efficiently.

The number shown in the third column (Quantity) is the quantity of items that are supplied against the stated Catalog Number. If the quantity is greater than 1, then only multiples of that quantity can be supplied.

C6.2 Spares and Accessories

Cat.	Description	Quantity
478621	Autosampler probe and tubing kit	1
478648	Fuse, 1A, time delay/slo-blo	2
001 42 498X	Line cord, without plug	1
858 040 001	Line cord, with plug, USA only	1
478645	Clot removal line, 0.5 m (19 1/2 inches)	1 pack
478785	Last sample flag (2) and hex key kit	1
478798	Sample tray	1
478799	Sample tray cover	1
478626	Urine starter pack, contains,	
-	Dispenser, 2 mL graduated in 0.1 mL steps	1
478543	Urine diluent, 500 mL,	1 bottle
-	Rack for sample cups,	1
478544	Urine Slope Standard, 50 x 1 mL ampules	1 pack
478115 (USA) or	Sample cups, pack of 1000	1 pack
001 26 074P (non USA)	Sample cups, pack of 1000	1 pack

C6.3 Solutions

Cat.	Description	Quantity
478692	614/604 Calibrating standard, 4 x 100 mL and 1 Deproteinizer pack	1 pack
478700	Deproteinizer, pack of 5	1 pack
478543	Urine diluent, 500 mL	1 bottle
478544	Urine slope standard, 100 mmol/L Na^+ and 120 mmol/L K^+, 50 x 1 mL ampules	1 pack
478652	Certain ISE, Lo, Mid and Hi QC Material, 10 x 0.5 mL ampules each level	1 pack

C7.1 Size

Width: 300 mm (12 inches)
Depth: 250 mm (10 inches)
Height: 220 mm (8 3/4 inches)

C7.2 Weight

4 kg (9 lb) 604 only
6.3 kg (14 lb) (approx) 604 with accessories, carton and packaging.

C7.3 Power Requirements

Fuse Rating	Two 1A fuses
Power Rating	30VA
Voltage Range	115V (90 to 132V) 230V (198 to 264V)

C7.4 Samples

Types

Serum, plasma, urine and QC samples.

Volume Required

Minimum cup volume = 250 µL serum/plasma/QC (150 µL used for measurement)
600 µL urine (450 µL used for measurement, post dilution)

C7.5 Stat Samples

Types

Whole blood, serum and plasma.

Volume Required

Minimum sample volume = 150 µL.

C7.6 Sample Throughput

40 position sample tray - 36 samples and 4 cal positions.
More than 60 samples/hour (serum/plasma/QC).
More than 50 samples/hour (urine).

Message List

This list shows the messages displayed when using the autosampler. Refer to Appendix A for a complete list of other messages.

The instrument response to answering yes to a question is shown.

ANALYZE BLOOD ?	The 614/604 is ready to be switched on line to measure serum or plasma samples.
ANALYZE URINE ?	The 614/604 is ready to be switched on line to measure urine samples.
AUTOSAMPLER ?	Selects autosampler mode.
AUTOSAMPLER START ?	Starts the autosampler run.
CAL FAILED - REPEAT?	Repeats calibration following failed calibration result.
CALIBRATING	Displayed when the 614 is measuring calibrating standard.
CALIBRATION OK	Calibration results within specification. Message alternates with Na=140 K=4.00 mmol/L.
CHECK SET-UP	Displayed if 614 has carried out a self-diagnostic test and reset all Set-Up menu parameters to default values. Alternates with AUTOSAMPLER ?.
CONNECT PROBE	Instruction to connect the autosampler probe tubing to the 614 probe.
MEASURING	Displayed when the 614 is measuring a sample. Message alternates with PLEASE WAIT during stat sample measurement.
Na=138 K=4.11 mmol/L	Example result.
PLEASE WAIT	Displayed alternately with MEASURING when a stat sample is being measured.
PROBE DISCONNECTED ?	Checks that the autosampler probe tubing has been disconnected from the 614 probe.
PROBE IN SAMPLE ?	Checks that autosampler probe is in sample.
PROBE OVER CAL ?	Checks that the 604 probe is over the first cal position before starting the autosampler run.
REMOVE STAT SAMPLE	Instruction to remove stat sample from autosampler probe.
RETURN PROBE	Instruction to lower 614 probe.
SAMPLE NOT DETECTED	Displayed if 614 is unable to detect sample. After two consecutive failures this message alternates with AUTOSAMPLER START ?.

Message List (cont)

SAMPLE TRAY LOADED ?	Checks that the sample tray is loaded with samples and calibrating solution.
SAMPLER FAILED	Displayed if autosampler probe is in wrong position for aspiration.
SAMPLER OFF ?	Selects autosampler off line routine.
SAMPLER RESTART ?	Returns the 614 to autosampler mode after measuring a stat sample.
SAMPLING	Displayed when the autosampler is aspirating a sample or calibrating standard; alternates with SAMPLING - WAIT when the 614 is aspirating stat samples.
SAMPLING - WAIT	Displayed alternately with SAMPLING when the 614 is aspirating stat samples.
SELECT OFF LINE	Returns the 614 to normal operation.
STAT NEXT	Ready to measure a stat sample as soon as the measuring or calibrating routine is finished.
STAT SAMPLE(>150uL)?	Ready to measure a stat sample via the 604 probe. Message will not appear during urine mode.
STOP NEXT	Displayed if stat/stop control is pressed during urine mode.
2PT (CAL+SLOPE) DUE	- Displayed alternately with PROBE DISCONNECTED ? at the end of an autosampler run if a 2-point standardization has become due during blood mode.

Ciba Corning warrants, subject to the conditions itemized within this document, through either Ciba Corning personnel or personnel of its authorized distributors, to repair or replace free of all charges, including labour, any part of this product which fails within the warranty time specified in this document as appertaining to this particular product. Such failure must have occurred because of a defect in material or workmanship and not have occurred as a result of operation of the product other than in accordance with procedures described in the Instructions furnished with this product.

Conditions and specific exceptions which apply to the above statement are as follows:

1. End-user warranty time commences on the date of delivery of product to end-users' premises.

2. 'Free of all charges' statement applies only in areas recognised by Ciba Corning as being serviced either directly by its own personnel, or indirectly through personnel of an authorized distributor. Products purchased outside these areas requiring service during the warranty period will incur charges relative to the travel/transit costs involved. However, products purchased in such an area will be serviced during the warranty period free of all charges providing they are returned, freight paid, to either Ciba Corning or by pre-arrangement to an authorized Ciba Corning distributor.

3. All maintenance, (other than operator maintenance as described in the Instructions), repairs or modifications have been made by Ciba Corning authorized personnel.

4. This product has where applicable been operated using Ciba Corning specified supplies and reagents.

5. QC materials containing ethylene glycol, caesium ions or excessive amounts of ammonium ions have not been used with this product.

6. Ciba Corning reserves the right to make any changes in the design or construction of future products of this type, at any time, without incurring any obligation to make any changes whatsoever to this particular product.

7. Reagents, supplies and user maintenance items are not included in this warranty which specifically excludes:

   Chemical reagents.

8. Repair or replacement of any part failing due to abnormal conditions including the following, are excluded from this warranty.

    a) Flood, lightning, earthquake, tornado, hurricane, or any other natural or man-made disaster.
    b) Fire, bombing, armed conflict, malicious mischief or sprinkler damage.
    c) Physical abuse, misuse, sabotage or electrical surge.
    d) Damage incurred in moving the product to another location.

9. User agrees to permit Ciba Corning personnel or personnel of its authorized distributor to make changes in the product which do not affect results obtained, but do improve product reliability.

Representations and warranties purporting to be on behalf of Ciba Corning made by any person, including distributors and representatives of Ciba Corning which are inconsistent or in conflict with the terms of this warranty, (including but not limited to the limitations of the liability of Ciba Corning as set forth above), shall not be binding upon Ciba Corning unless reduced to writing and approved by an officer of Ciba Corning.

Warranties

614 Na^+/K^+ Analyzer	- Twelve (12) months
Na^+ Electrode	- Twelve (12) months
K^+ Electrode	- Six (6) months
Reference Electrode Inner	- Twelve (12) months
604 Autosampler	- Twelve (12) months

614 Na^+/K^+ Analyzer

Service Manual

CIBA·CORNING

614 89 003N Rev. A, 7/89

The 600 Series instruments are ISE analyzers designed for fast and accurate measurements of serum, plasma and whole blood.

The 614 measures sodium and potassium and uses a minimum sample volume of 35 uL.

The service manual contains complete instructions for servicing the 614.

WARNING The 614 is designed to be grounded through the power supply lead (line cord) for safe operation. For the safety of operating personnel make sure that the instrument is only connected to 3-prong sockets (outlets) that have an effective earth connection. If you are in any doubt as to the safety of your electical supply system consult a competent, qualified electrician.

There are no user replaceable parts within the instrument. Do not remove the covers from the 614.

Ciba Corning and their Authorized Distributors and Agents consider themselves responsible for the effects on safety, reliability and performance of the 614 only if :

(i) assembly operations, extensions, re-adjustments, modifications or repairs are carried out by persons authorized by them.
(ii) the electrical installation of the relevant room complies with IEC requirements or the local regulatory code, and
(iii) the equipment is used in accordance with the instructions for use.

The information contained in this manual was correct at the time of going to print. However, Ciba Corning policy is one of continuous product improvement and the right to change prices, specification, equipment and maintenance procedures at any time, without notice, is reserved.

The 614 Analyzer is classed as IEC Type B equipment (Class 1 equipment providing an adequate degree of protection against electric shocks particularly regarding allowable leakage currents and reliability of the protective earth connection).

New

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1.1 Introduction

The 614 is a direct reading, sodium and potassium analyzer. Results and operator interaction are performed via a 20 character alphanumeric display. The 614 is designed for fast, accurate determination of sodium and potassium levels in biological samples, i.e. serum, plasma and whole blood without the need for pre-dilution. It also has the capability to determine sodium and potassium levels in pre-diluted urine samples.

All results and calibrations can be recorded on the integral printer. Minimum sample volume is 35 uL.

This manual contains complete instructions for setting up and servicing CME (IEC) and CMNA (UL/CSA) versions of the 614, with serial numbers of 2001 upwards.

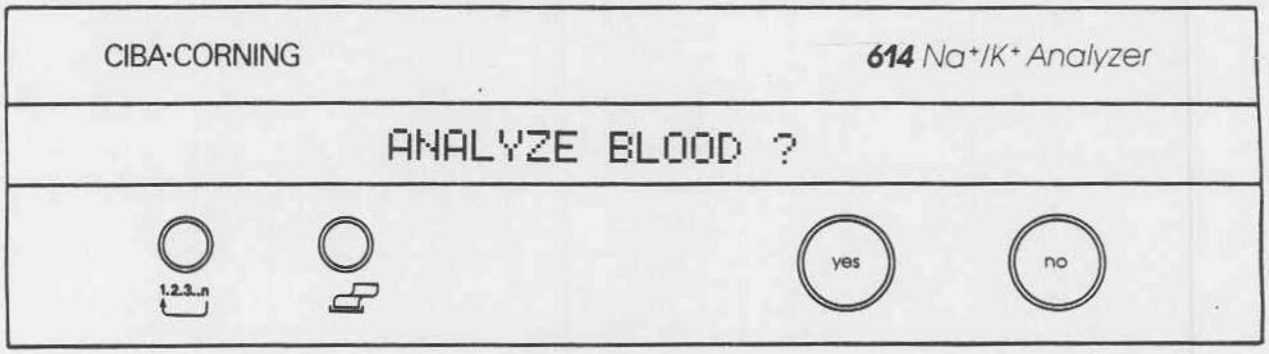
2.1 User Controls and Displays

Alpha-Numeric Display

20 digit character vacuum fluorescent display for presentation of results and operator options and status information.

Printer

16 character dot matrix impact printer for recording results, calibrations and set-up data.



sample number paper advance
reset

controls used to respond
to questions displayed
by the 614

Yes

Control used to accept option offered by display.

No

Control used to reject option offered by display. (Also used to cause scrolling numbers when entering data. When used in conjunction with Sample No. reset causes reverse scrolling of numbers.)

Paper Advance

Control used to advance paper from printer.

Sample No. Reset

Control used to reset the sample number counter to 1.

N.B. For full details of Yes/No display interaction see Sections 2 and 3 of the Instruction Manual

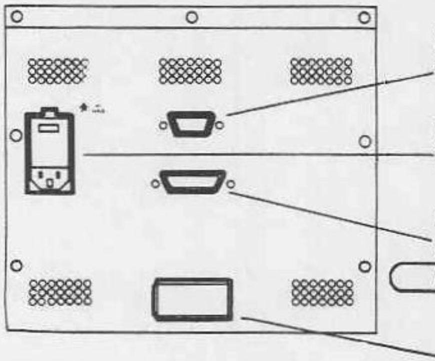
2.2 Rear Panel Connectors and Displays

Power

Input AC power connector incorporating fuses and voltage selection.

IEC symbol denoting Type B equipment

⚠ IEC symbol advising user to refer to accompanying documentation



peripherals control, 15-way D-line socket

power connector, voltage selector and fuses

data output, 25-way D-line socket
Security key is fitted here if
(SECURITY ON ?) is selected

status indicators cover

Peripherals Socket

15-way socket to allow for interconnection with Model 604 Autosampler (see Appendix C of Instruction Manual). (The 604 Autosampler is for use with the 614 only)

Data Output

25-way socket for connection to ticket printers, roll printers and data management systems. Also used for security key when "SECURITY ON?" is displayed.

If the hydraulic test simulator (478567) is used then it is plugged into this socket.

Status Indicators

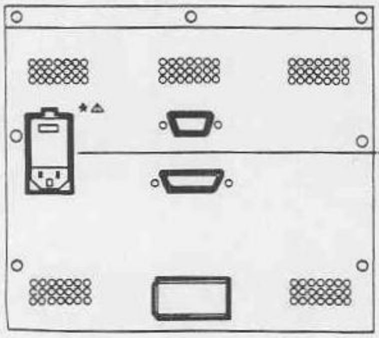
There are ten LED's (Light Emitting Diodes), located under the status indicators cover on the rear panel. Their purpose is to aid in the diagnosis of faults.

N.B. The 614 has no internal adjustments.

2.3 The Rear Panel - Selecting Voltage

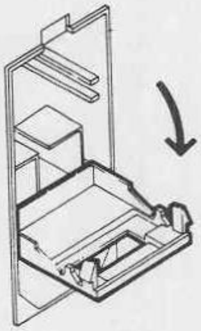
* IEC symbol denoting Type B equipment

⚠ IEC symbol advising user to refer to accompanying documentation

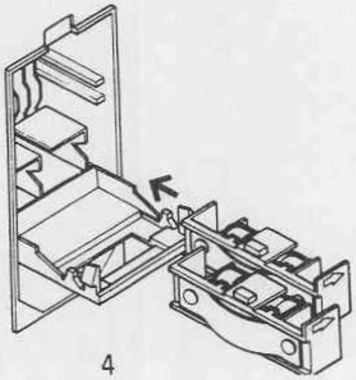


power connector, voltage selector and fuses

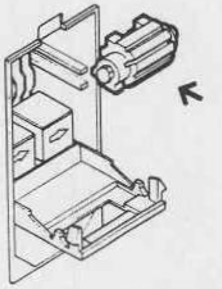
Open the voltage selector cover with the screwdriver supplied



Insert the two fuses into the fuseholders and slide the fuseholders into the voltage selector.



2.3 The Rear Panel - Selecting Voltage (cont)

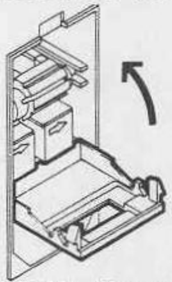


Select the voltage required for the local supply.

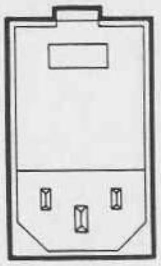
Voltage Selected	Voltage Range
100V	85V to 110V
120V	102V to 132V
220V	187V to 242V
240V	204V to 264V

Slide the voltage selector bobbin into the voltage selector so that the selected voltage is visible when the voltage selector cover is closed.

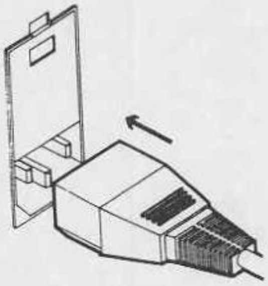
CAUTION : Do not rotate the bobbin when it is fitted in the voltage selector as this will damage the contacts.



Close the voltage selector cover



Voltage selected



If necessary, connect a suitable plug to the line cord. Connect the line cord to the power connector on the rear panel.

NOTE : Do not connect the line cord to the power supply.

3.1 General

The 614 Na/K Analyzer is available in two versions. One for use in the United States of America and Canada which is the UL/CSA version and one for the Rest of the World which is the IEC version. It is also available in four dual language options - English/Spanish, English/German, English/French and English/Japanese.

3.2 Mechanical

Please refer to exploded views EV1 to EV3 when reading the following description.

The casework of the instrument is a combination of plastic mouldings and sheet metalwork. There is a main body moulding, item 29, to which is attached a sheet metal base plate. The main hydraulic components, i.e. the mainfold, solenoid, electrode block, and probe assembly, are mounted on the front of the moulding. The motor/gearbox for driving the pump is mounted on the rear of this moulding.

The touch panel and display are mounted on the front cover moulding which has the electrode door cover hinged to it. The whole assembly fits to the main body of the instrument from the front.

The rear of the instrument contains the electronic system, a transformer assembly and three printed circuit boards which are interconnected by various cables. The main power board is mounted to the base plate, the CPU board is affixed to the rear panel and the amplifier board is attached to the main moulding in the rear at the top. The transformer is fixed to the baseplate with the input filter assembly attached to the rear cover.

3.3 Block Diagram

Please refer to Figures 1a and 1b when reading the following description.

Hydraulics

Solution is aspirated through the probe from either the weir (during cal and flush cycles) or a sample container (during sample measurements). It passes through sample detector 1 (SD1), through the electrodes and sample detector 2 (SD2) through the pump tube cassette to waste. SD1 and SD2 are used by the microprocessor to control the flow of solution during the measurement cycle.

The flow of cal/flush for the weir is controlled by valve 2. Valve 1 directs the flow of slope solution which is delivered to the electrodes during a slope measurement via the T-junction.

The three routines which the instrument carries out during operation are described as follows :

Sample Measurement

- Motor drives slowly to draw sample until detector 1 is reached. Valves 1 and 2 divert slope and cal solution back into reservoirs.
- Motor stops and 'RETURN PROBE' command is displayed upon which motor runs slowly again to advance sample to detector 2. (N.B. This point having been reached is indicated by date/time being printed) Valves 1 and 2 divert slope and cal back into reservoirs.
- Upon completion of measurement (i.e. plateau reached and result displayed/printed) valve 2 changes to supply cal/flush to weir and motor runs fast to clean the electrode system. Valve 1 diverts slope back into its reservoir. Pump 2 removes excess cal/flush solution to waste.

Cal Routine

- Valve 2/pump 4 supplies cal/flush to weir and motor runs fast to prime the system. Valve 1 diverts slope back into its reservoir.
- Motor changes to slow speed and draws cal/flush to detector 1.
- Valve 2 reverts to diverting cal/flush to its reservoir and motor continues to run slow until detector 2 is reached. (N.B. Again indicated by date/time print)
- Upon completion of cal measurement (i.e. plateau is reached and cal value is displayed/printed) flush cycle is performed as for sample measurement routine.

Slope Routine

- Slope always follows cal as described on previous page
- Following cal routine flush valve 1/pump 3 supplies slope solution via the slope input tee. Valve 2 diverts cal/flush back into its reservoir.
- Motor runs fast to prime slope then slowly until detector 2 is reached. (N.B. Indicated by 'Slope' being printed)
- Upon completion of slope measurement (i.e. plateau is reached and slope value is displayed/printed) flush cycle is performed as for sample measurement routine.

Electronics

The signals from the electrodes are connected to the amplifier board via connectors X1-X4. Sample detector outputs and the thermistor sensor are also connected to the amplifier board via PL14. The amplifier board also acts as an interface for the touch panel.

Control of the amplifier board is through the 20 way cable linking PL13 of the amplifier board with PL3 of the CPU board.

The CPU board controls the display through PL16 and supplies data output and sampler control through SK4 and SK5 respectively. It also generates the control signals for the printer and electro-mechanical components which are passed to the power board by the 20 way interconnection PL1 to PL10. Power from the CPU board is derived through the 12 way cable PL2 to PL11.

The power board generates the DC voltage requirements for the system and also the power control of the solenoids, motor and printer. The raw AC power enters the board through PL7.

Control of the printer is through PL8. PL9 delivers the control lines to the two solenoids, the pump motor and acts as an interface for the probe microswitch.

3.4 Circuit Descriptions

3.4.1 Power Board (903 41 001E) Refer to Figure 4

The functions of the power supply board are to generate the various DC voltages needed by the system together with self-monitoring circuitry to ensure reliable fail-safe operation. In addition to DC voltages the board contains the circuitry to drive the various electromechanical devices, i.e. solenoids, motors, printer, etc. It also generates the main reset control lines for the CPU.

a) Power Supplies

AC supplies from the transformer are fed to the power board by PL7.

The +5 volt power supply is generated by rectifying the AC output of the transformer via MR2 and regulation is achieved by IC10.

A regulated +12 volt power supply is generated by MR1 and IC11. The 25 volt supply is derived from the raw DC input to IC11.

An unregulated -12 volt supply is generated by MR3 and C21.

The + and -12v supplies are used to generate a stable ± 6 volt supply for critical analogue circuitry. This is done utilising IC2 and its associated components.

Two other power supplies are included on the board. Firstly a printer supply is generated from the raw DC supply on the imput to IC10. This supply is regulated and controlled through IC8. Secondly the reserve power supply for backing up the system RAM is generated by IC1, TR1 and C14 and maintains the back up power during power down situations.

The status of the printer supply is monitored by IC4 which senses when the printer supply drops significantly below 5 volts. When this occurs, pin 6 of IC4 goes low. This line drives the printer protection circuitry located in the CPU board to prevent damage to the printer.

Advance warning of failure of the main +5 volt supply is detected by D4, D5 and IC6. The output of IC6 (pin 6) goes low switching off the printer power supply through TR2 and TR3. It also drives a line going to the CPU board to generate a high priority interruption the CPU to allow controlled shutdown of CPU operation.

The main CPU reset is generated by IC3 which is a precision voltage monitor. If the voltage drops to below 4.65 volts pin 6 goes high generating a system reset. As the voltage drops lower IC5 takes control of the reset function and maintains it to lower voltages. The chain formed by R15, R19 and the three diodes D8, D9 and D10 maintain the reset state at very low voltages.

b) Printer Interface

The printer solenoids are driven by TR11-TR14. D13-D15 protects against back EMF voltages generated by the solenoids. TR7 and TR8 control the printer motor and TR6 generates a square wave from the tachometer in the printer. All the printer signals are fed to the printer via PL8.

c) Pump Control

The analogue voltage which controls the speed of the pump motor is fed in through PL10 pin 5 for IC9-A. The output of IC9-A is coupled to the motor through the emitter-follower TR4. The motor is switched on and off through TR8 and TR10 which are controlled from an output port on the CPU board through PL10 pin 4.

d) Solenoid and Other Control Functions

IC7 controls the slope solenoid and the cal/flush solenoid through PL9 pins 2 and 6. IC7 pin 16 controls the audio generator. IC7 interfaces between output logic signals generated on the CPU board which are fed into the power board via PL10. TR5 can be used to control a heater if required (this function is not used on the 614). It is used on the 634 to maintain the electrode block at 37°C. Control is achieved through software turning TR5 on and off with a variable duty cycle.

e) Connection Summary

PL7	-	AC input from transformer
PL8	-	Printer
PL9	-	Pump/solenoid/probe microswitch I/F
PL10	-	CPU control signal I/F
PL11	-	Power O/P

3.4.2 CPU Board (903 42 001P) Refer to Figure 5

The CPU board design is based on the 8085 microprocessor. The memory can be configured by links (LK1 and LK2) to either 62K PROM and 2K RAM or 56K PROM and 8K RAM. The basic 8085 system is comprised of IC7 (8085 microprocessor), IC3 (512K EPROM),IC6 (2kx8 RAM), IC5 (8251 UART), IC14 and IC19 (8155 I/O and Timer) and IC19 (8259 interrupt controller). The basic configuration is a standard 8085 system design.

Device decoding is done by IC21 which generates the individual chip selects for the various IC's.

Memory decoding is done by the collection of gates formed by IC11-A,IC20-A, IC20-B, IC20-D, IC22-A, IC23-A, IC23-D and IC27-A. With LK1 in place and LK2 in position B the memory map is set for 62K EPROM and 2K RAM for 614 operation.

IC28 is a real time clock device which controls time and date once it has been set.

Input/Output is performed by IC14 and IC19. IC14 uses port B to send data to the display or the printer depending on which one is selected. Port A of IC14 is used to control the DAC IC12 which generates the voltages necessary for electrode offset and pump speed control. The touch panel is interfaced through port C of IC14.

IC19 port B generates control signals for the amplifier PCB. Port A controls the solenoids and turns the pump on and off. Port C generates control signals from the sampler port via the buffer IC18. IC14 and IC19 also generate timing signals. IC14 pin 6 generates the main operating system timer through the RST 7.5 interrupt of the 8085. IC19 pin 6 is used for the baud rate clock generator for the UART (IC5).

Data communication by the UART (IC5) is achieved by the use of IC1 and IC9 as the RS232 transmit and receive buffers respectively. 20 mA current loop operation is done by TR1 (transmit) and IC9 pins 1 and 3 (receive).

Printer control is done through IC10 which is a printer microcontroller chip. The solenoid drivers are buffered through IC1 which is only enabled when the printer power supply is in the right condition.

Analog to Digital conversion of all the main signals is achieved via IC26 which is a single chip (12 bit and sign) A/D convertor. Control of the convertor is through IC22-B, IC22-C, IC23-C and IC27-B. The A/D clock is derived from the system clock through the counter IC17-A which divides the system clock by 16 to generate a suitable frequency for the A/D convertor.

The arrangement of IC's comprised by IC8, IC13, IC15, IC16A, IC16-F, IC20-C and IC22-D is the watchdog circuitry. IC8 is a 200 mS oscillator which would reset the processor every 200 mS if left alone.

The software inhibits the oscillator on a periodic basis by means of the trigger pulses generated by IC21 pin 7 and IC19 port A7. If the software being executed is illegal the oscillator IC8 will cause a reset which will restart the processor under known conditions.

DP1 is an LED bar graph display which indicates the status of various power supplies and control lines.

LED No.	Function	Normal (i.e. Good) Status
1	AC power	On
2	+ 12V	On
3	+ 5V	On
4	- 6V	On
5	Cal/Flush Solenoid	On when active
6	Microprocessor	Flashing
7	Slope Solenoid	On when active
8	Pump Motor	On when rotating
9	Not used	Off
10	Microswitch (probe)	On when probe open

Connection Summary

PL1	CPU Control Signal I/F
PL2	Power I/P
PL3	Amplifier Control Signal I/F
SK4	Data O/P Connector
SK5	Peripheral Control Connector
PL6	Display I/F

3.4.3 Amplifier Board (903 40 001J) Refer to Figure 3

The amplifier board is the interface between the main signal transducers (electrodes, sample detectors, etc) and the rest of the electronics system.

The electrodes are interfaced via a switched differential amplifier system comprised of IC8, IC9, IC10, IC1-A, IC5-A and IC5-B.

IC5-A and B switches the amplifier between the reference electrodes (input X3) and Sodium (X1) and reference (X3) and potassium (X4). The switching is controlled by the microprocessor. The microprocessor also switches the appropriate signal to the A/D convertor through the multiplexer IC2.

IC3-A and IC4-A are gain adjusting and filter amplifiers which also add in the offset voltage generated by the CPU to put the signals in the correct dynamic range.

Sample detector interfaces are done by IC6-A and IC7-A which are unity gain buffers. The outputs are fed to the A/D convertor through the multiplexer IC2 under processor control.

Connection Summary

X1-X4	Electrode interface
PL12	Touch Panel I/F
PL13	Amplifier Control Signal I/F
PL14	Sample Detection I/F
PL15	Heater Drive (not used on 614 only used on 634)

4.1 Scheduled Maintenance

Daily Maintenance

Equipment
Cal-Pak as required;2% activated glutaraldehyde solution(eg CIDEX[TM])
Clean tissues.

NOTE : Do not add other decontaminants, e.g. hypochlorite, to the glutaraldehyde solution.

1. Check levels of calibrants and replace with new Cal-Pak if necessary, Section 4.2. The Cal-Pak will probably need replacing once a week.
2. Check that the probe is straight and centred over the weir when in the closed position. Realign or replace if necessary, Section 4.12.
3. Wipe the sample area, calibrant compartment and the external surfaces with clean tissues moistened with 2% activated glutaraldehyde solution.
4. Clean the weir cover, Section 4.6.

Three-monthly (Quarterly) Maintenance

Equipment
Items listed under "Daily Maintenance"; pump tube cassette; weir cover, as required; reference electrode cassette; Na+/K+/Ca++ electrode fill solution.

Carry out daily maintenance and :

1. Disinfect the 614, Section 4.3.
2. Replace the weir cover, if necessary, Section 4.6.
3. Replace the pump tube cassette, and clean and lubricate the roller assembly, Section 4.9.
4. Replace the reference electrode cassette (not the inner electrode), Section 4.10.
5. Check Na+ and K+ electrode fill solution and refill the electrodes if necessary, Section 4.11.

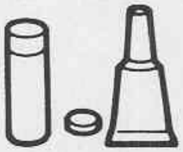
[TM] Surgikos Ltd., Livingston, Scotland

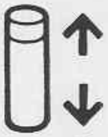
4.2 To change the Cal-Pak, Deproteinize and Condition the Electrodes

Equipment
Cal-Pak, Deproteinizer (D) and Conditioner (C), Cat. 478541 (614), 478548 (634); or Deproteinizer and Condition multi-packs, Cat. 478700 and 478701.

This section also shows the procedure for deproteinizing/conditioning the electrodes using the (DEPRO / CONDITION ?) routine.

NOTE : Activate the Deproteinizer with a pepsin table before starting this procedure, as the tablet will take between 10 and 15 minutes to dissolve.

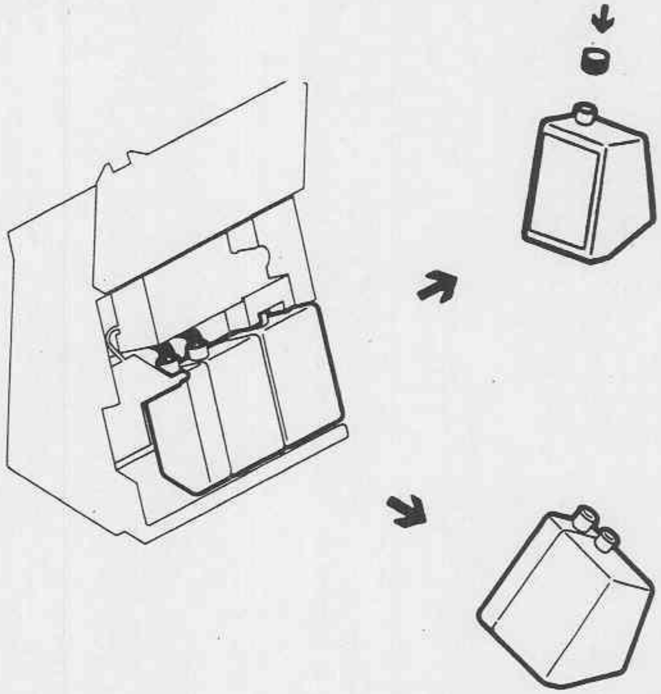




Cap and shake the vial until the pepsin tablet has dissolved, or leave to stand for 15 minutes. The pepsin tablet must be completely dissolved before the solution is used.

If you are deproteinizing and/or conditioning the electrodes and not changing the Cal-Pak, the routine starts on the next page, at (DEPRO / CONDITION ?)

(SERVICE REAGENTS ?)
▼
yes
▼
(CAL-PAK CHANGED ?)
▼



4.2 To Change the Cal-Pak, Deproteinize and Condition the Electrodes (contd)

▼

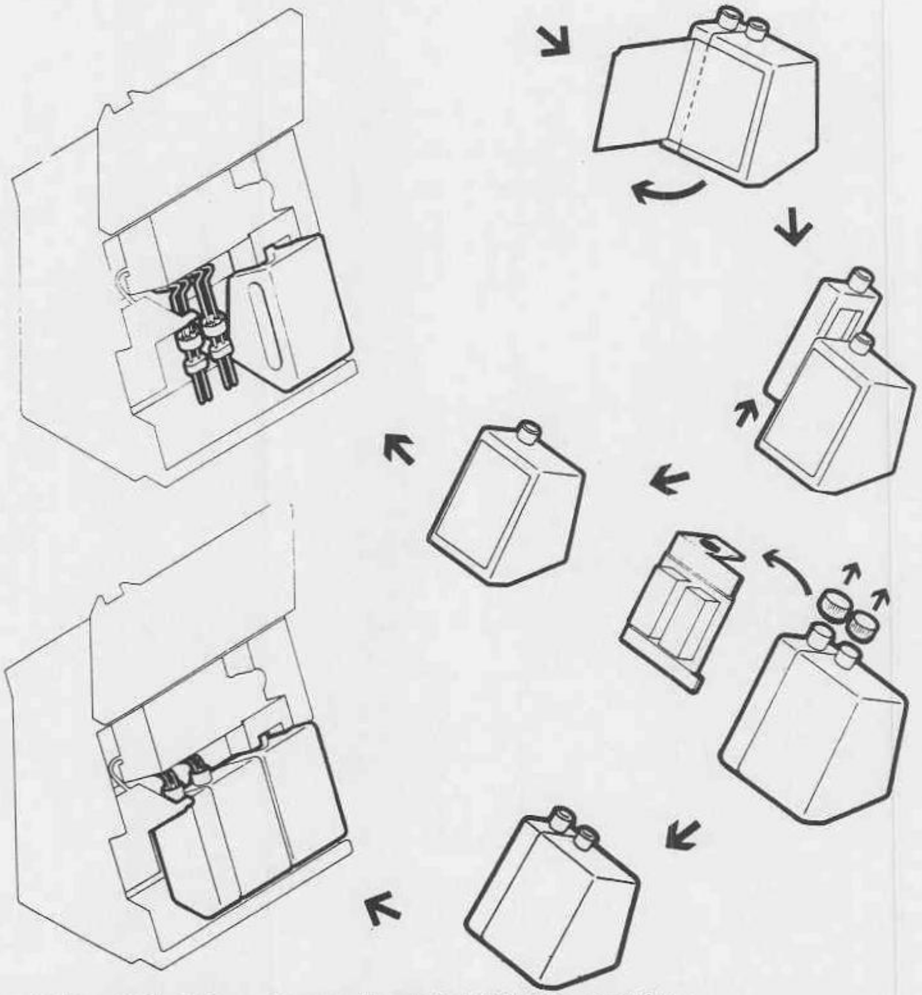
▼

▼

(yes)

▼

(WAIT - PRIMING)



If you have not changed the Cal-Pak and are deproteinizing and/or conditioning the electrodes using the (DEPRO / CONDITION ?) routine, start here. If the Cal-Pak has been changed, continue with (DEPROTEINIZE ?)

(DEPRO / CONDITION ?)

This message will not be displayed in the (SERVICE REAGENTS ?) routine

(yes)

▼

(DEPROTEINIZE ?)

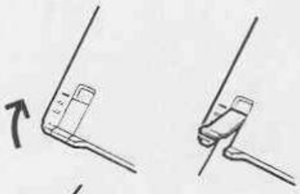
(yes)

4.2 To change the Cal-Pak, Deproteinize and Condition the Electrodes (contd)

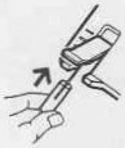
▼

OPEN PROBE

▼



PROBE IN SOLN D ?



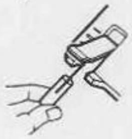
NOTE : SOLN D = Activated deproteinizer

yes

▼

SAMPLING

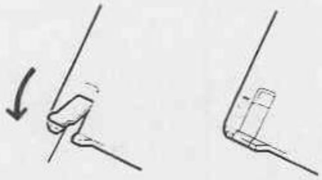
SAMPLING - WAIT



▼

RETURN PROBE

▼



DEPROTEINIZING

WAIT 5:00 MINUTES (counts down to zero)

▼

If it is essential to measure a sample during this routine, press

no

FLUSHING

▼

CONDITION ?

no

The 614 will standardize

▼

ANALYZE BLOOD ?

When sample measurement is complete repeat the deproteinizing routine.

▼

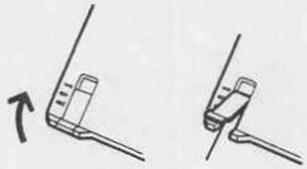
CONDITION ?

yes

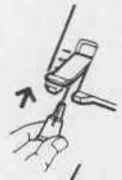
4.2 To Change the Cal-Pak, Deproteinize and Condition the Electrodes (contd)

▼

OPEN PROBE



PROBE IN SOLN C ?



NOTE : SOLN C = Conditioner

(yes)

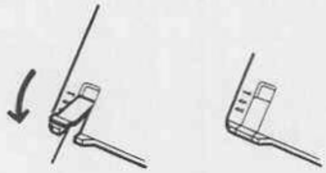
▼

SAMPLING

SAMPLING - WAIT

▼

RETURN PROBE



▼

CONDITIONING

WAIT 5:00 MINUTES (counts down to zero)

▼

If it essential to measure a sample during this routine press

(no)

The 614 will flush then standardize

▼

ANALYZE BLOOD ?

When sample measurement is complete repeat the conditioning routine.

▼

FLUSHING

▼

The 614 will now carry out an automatic standardization

▼

ANALYZE BLOOD ?

4.3 To Disinfectant the 614

Equipment
Disinfectant - 2% activated glutaraldehyde solution (e.g. CIDEX^{TM})

NOTE : Do not add other decontaminants, eg. hypochlorite, to the glutaraldehyde solution.

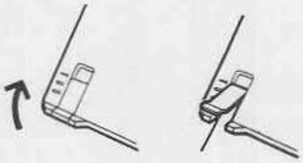
WARNING : This procedure disinfects the 614 sample path and should always be done before replacing the pump tube cassette, connecting tubing etc. It should also be carried out after analyzing a sample known or suspected to contain dangerous pathogens.

The (DEPRO / CONDITION ?) routine is used to disinfect the 614.

(DEPRO / CONDITION ?)

(yes)

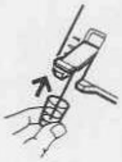
(DEPROTEINIZE ?)



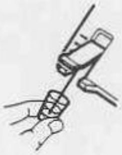
(yes)

(OPEN PROBE)

▼



(PROBE IN SOLN D ?)



NOTE : In this routine, SOLN D is disinfectant

(yes)

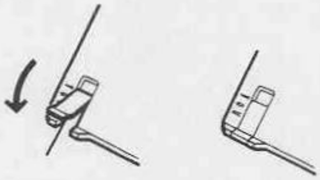
(SAMPLING)

(SAMPLING - WAIT)

▼

(RETURN PROBE)

▼



(DEPROTEINIZING)

(WAIT 5:00 MINUTES) (counts down to zero)

▼

If it is essential to measure a sample during this routine, press

no

TM Surgikos Ltd., Livingston, Scotland

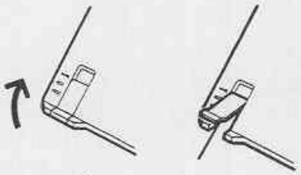
4.3 To Disinfect the 614 (contd)

▼

▼

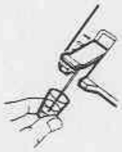
CONDITION ?

yes



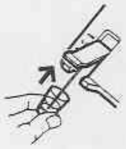
OPEN PROBE

▼



PROBE IN SOLN C ?

yes



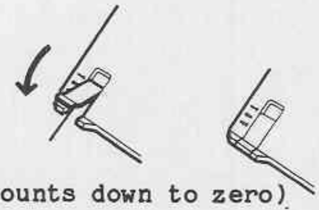
SAMPLING

SAMPLING - WAIT

▼

RETURN PROBE

▼



CONDITIONING

WAIT 5:00 MINUTES (counts down to zero)

▼

▼

The 614 will flush then standardize

▼

ANALYZE BLOOD ?

▼

FLUSHING

▼

CONDITION ?

no

▼

The 614 will standardize

▼

ANALYZE BLOOD ?

NOTE : In this routine SOLN C is disinfectant

If it is essential to measure a sample during this routine press

no

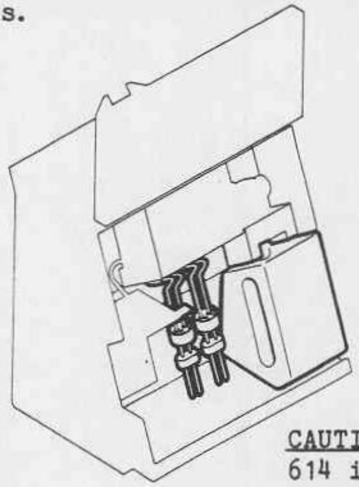
The 614 will flush then standardize

▼

ANALYZE BLOOD ?

4.4 Drain Routine

Use this routine when replacing the pump tube cassette, connecting tubing, manifold and solenoids.



DRAIN ?

yes

CAL-PAK REMOVED ?

yes

WAIT - DRAINING

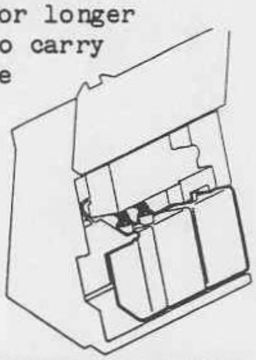
▼

DRAINING COMPLETED

CAL-PAK REPLACED ?

▼

CAUTION : Do not leave the 614 in this mode for longer than is required to carry out the maintenance procedure



Carry out the maintenance procedure

▼

yes

WAIT - PRIMING

▼

PRIME AGAIN ? yes AUTO PRIME ? yes ▶ WAIT - PRIMING

no

no

▼

MANUAL PRIME yes ▶ Press and hold until solution flows into the waste bottle, then press

no

The 614 will now carry out an automatic standardization.

▼

ANALYZE BLOOD ?

4.5 System Stop Routine

Use this routine when replacing the electrodes, probe and tubing, micro switch, sample detectors, slope inlet block, or when clearing blockages.

(SYSTEM STOP ?)

(yes)

▼

(RESTART SYSTEM ?)

▼

CAUTION : Do not leave the 614 in this mode for longer than is required to carry out the maintenance procedure.

Carry out the maintenance procedure.

(yes)

▼

The 614 will now carry out an automatic standardization.

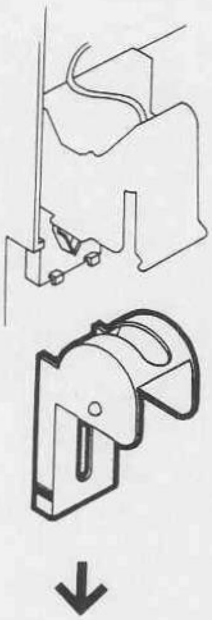
▼

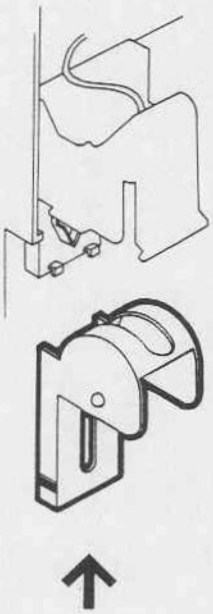
(ANALYZE BLOOD ?)

4.6 To Clean/Replace the Weir Cover

Equipment

Disinfectant - 2% activated glutaraldehyde (e.g. CIDEX^{TM}); Clean tissues; weir cover, Cat. 478633, as required.





To clean the weir cover, wipe with clean tissues moistened with disinfectant.

^{TM} Surgikos Ltd., Livingston, Scotland

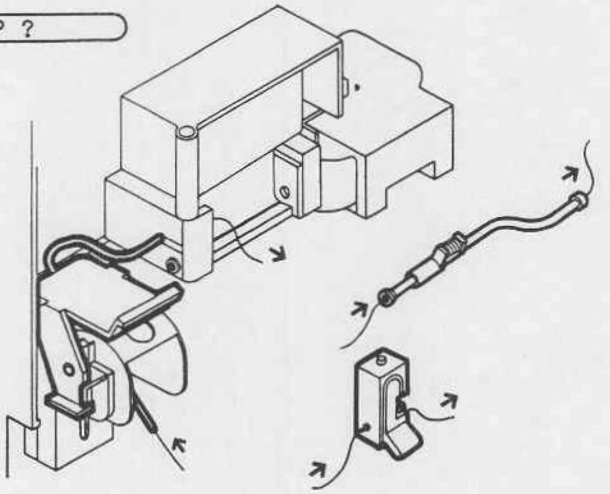
4.7 To Clear Blockages

Equipment
Clot removal line, Cat. 478645; 1ml syringe, as required

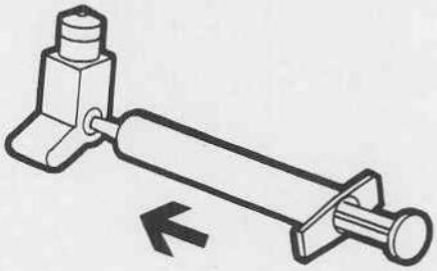
WARNING : Always wear protective gloves when carrying out this procedure.

CAUTION : Only use Ciba Corning clot removal line during this procedure as other materials may damage the 614.

Select (SYSTEM STOP ?)



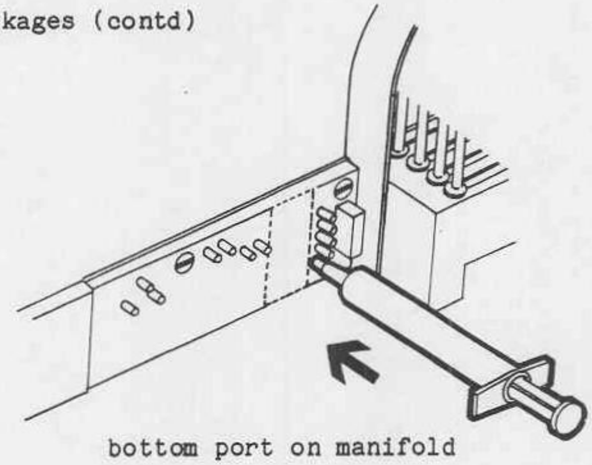
To clear a blockage in the probe, probe tubing or waste tube.



21

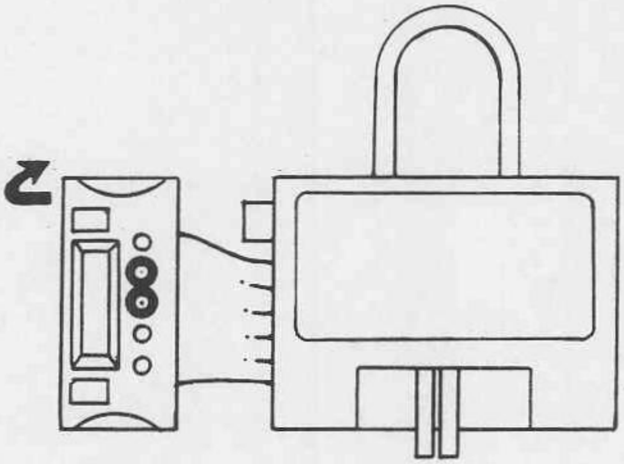
To clear a blockage in the K+, Na+ or reference electrode.
Deionized water may be used.

4.7 To Clear Blockages (contd)



bottom port on manifold

To clear a blockage in the weir drain hole or manifold.



To clear a blockage in the pump tube cassette, inject approximately 5 mL of deionized water into ports 2 and 3, followed by air to remove the water. Hold the cassette block away from you during this procedure.

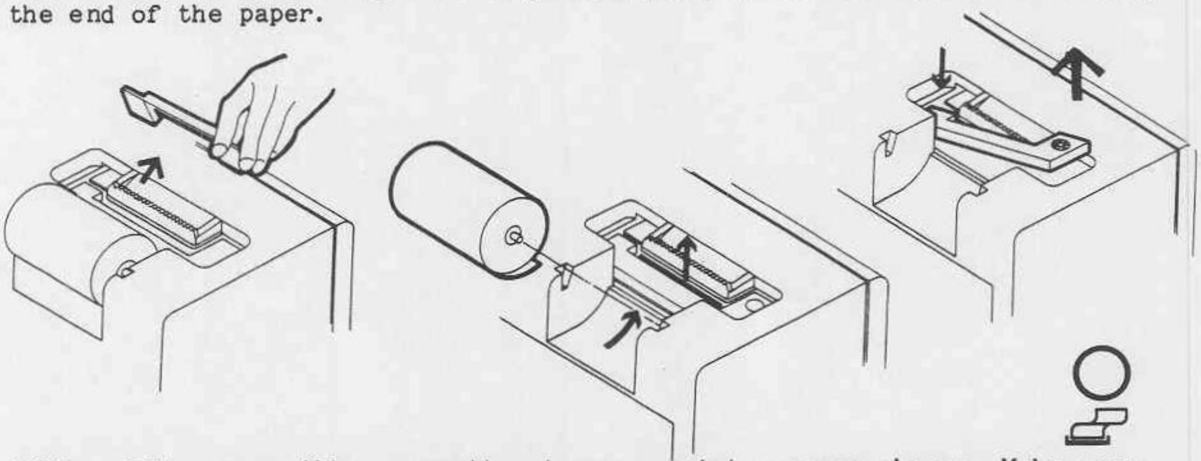
Deproteinize the electrodes, Section 4.2.

4.8 To Replace the Printer Paper and Ribbon

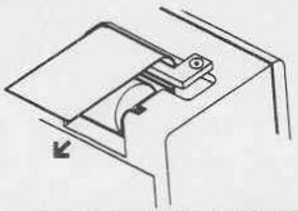
Equipment
Printer paper, Cat.478638; Printer ribbon cassette, Cat.478637.

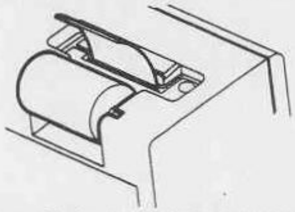
NOTE :
To clear a paper jam, tear the paper and remove the paper roll. Press to advance the piece of paper through the printer. If this is not possible, pull the piece of paper towards you out of the printer.

Before loading the new paper roll, remove accumulated paper dust with a soft brush, or by blowing. Loading the paper may be made easier by cutting the end of the paper.



NOTE : Fit a new ribbon cassette at every printer paper change. Make sure the printer paper is in place before fitting the printer ribbon cassette.





Pull the printer paper tight towards the rear of the 614 and feed the paper between the ribbon and the cassette. Holding the paper taut, slide the cassette towards the front of the 614, then press down to lock into place.

Replace the printer cover.

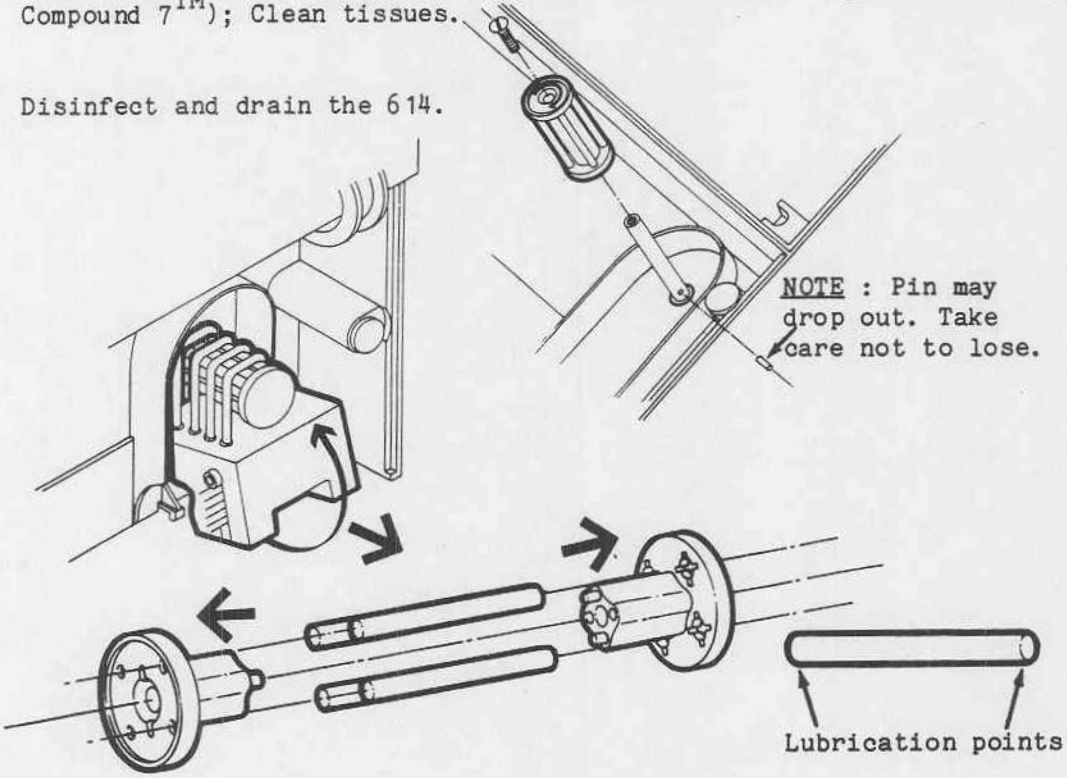
Check that the paper feeds correctly by pressing ○. Carry out a display and printer test, Section 4.19, to check that the printout is clear.

4.9 To Replace the Pump Tube Cassette, Clean and Lubricate the Rollers

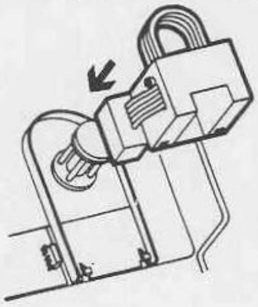
Equipment

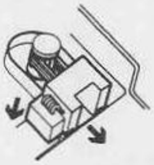
Disinfectant; pump tube cassette, Ca.478639; Screwdriver, supplied with Installation Pack; Mild detergent; Silicone grease (e.g. Dow Corning Compound 7[TM]); Clean tissues.

Disinfect and drain the 614.


NOTE : Pin may drop out. Take care not to lose.
Lubrication points

Wash the rotor assembly in mild detergent solution, rinse and dry with tissues. Lightly lubricate each roller at the points shown. Reassemble.





Date the pump tube cassette label three months ahead

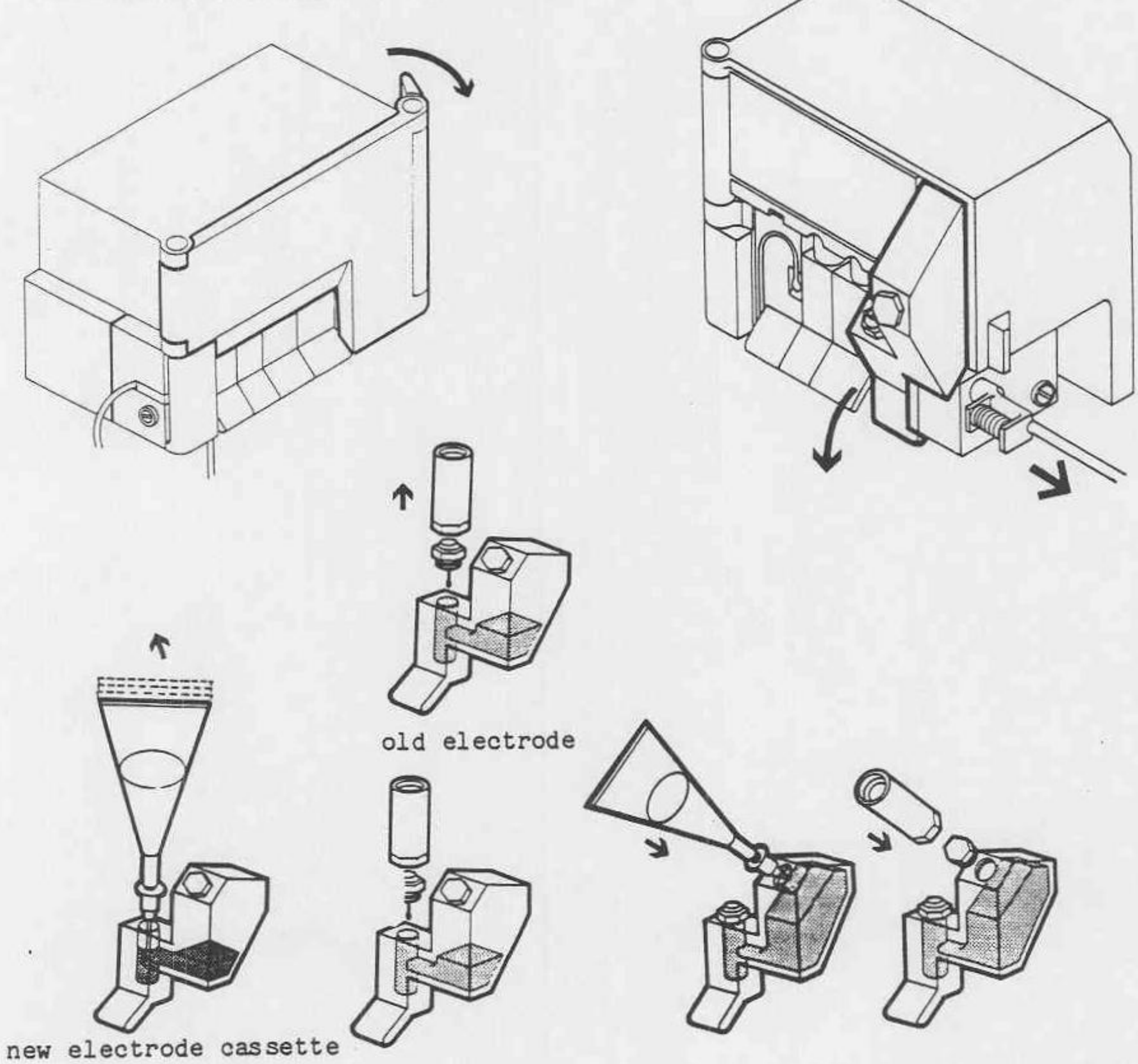
[TM] NV Dow Corning S.A. Belgium

4.10 To Replace the Reference Electrode Cassette

Equipment

Disinfectant; Reference electrode refill, Cat. 478498.

Disinfect and stop the 614 system.

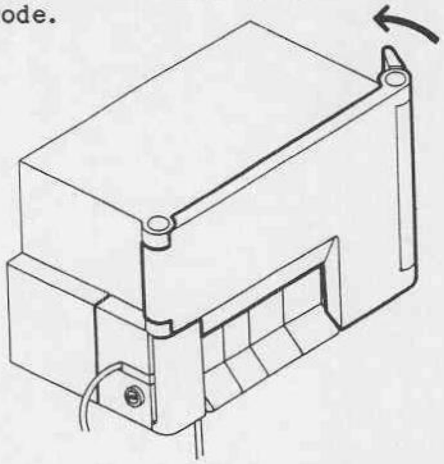


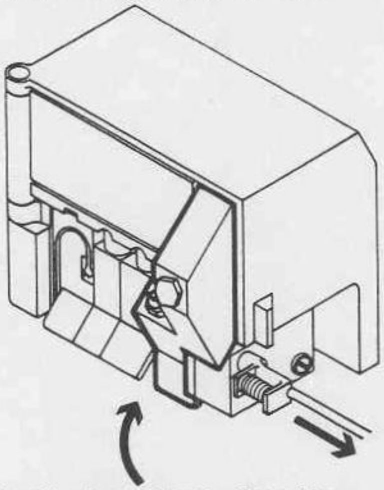
Use the hex tool supplied to unscrew and tighten the reference electrode inner and reservoir sealing plug. Remove the electrode plug and the reservoir sealing plug. Break the top off the reference electrode fill solution container, and fit the needle.

4.10 To Replace the Reference Electrode Cassette (contd)

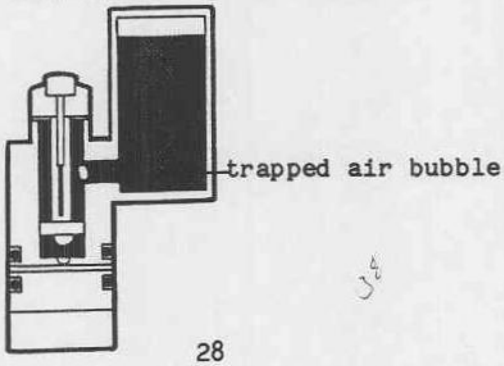
CAUTION : Do not use Na+/K+/Ca++ pH electrode fill solution

Slowly inject solution into the reference electrode fill hole, avoid trapping air bubbles. Tap the electrode during filling to dislodge air bubbles. Continue filling until a bubble of solution appears at the electrode fill hole - the level of solution in the electrode cassette will decrease until the KCl crystals are wet. Remove the electrode inner from the old cassette and screw into the electrode fill hole. Continue to inject the remaining fill solution into the reservoir, but be careful not to overfill. Replace the plug. Shake the electrode down, like a thermometer, to dislodge air bubbles at the electrode tip. Make sure the vent hole is not blocked. Carefully clean off any excess fill solution using dry tissue and, if necessary, fit an 'O' ring to each side of the electrode.





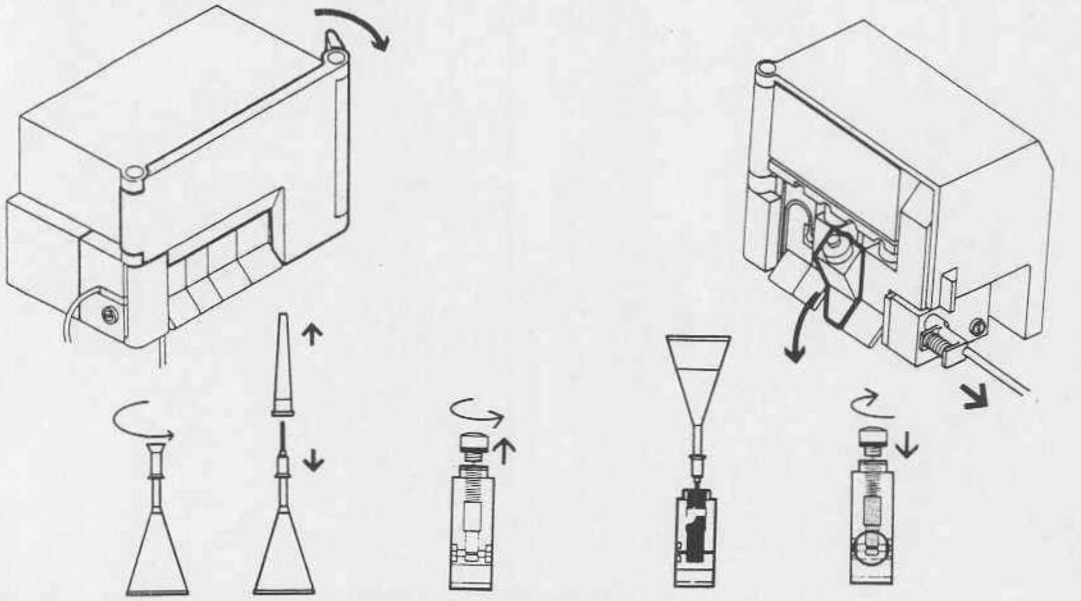
NOTE : Following a change of reference electrode it is normal for the 614 to require a stabilization period of 30 minutes before optimum performance is obtained. If an OVER RANGE or UNDER RANGE reading is displayed on both channels, there is probably an air bubble trapped in the reference electrode. Remove the electrode and tap it until the air bubble has been dislodged. Re-install the electrode.



4.11 To Fill the Na+ and K+ Electrodes Ca++ and pH electrodes

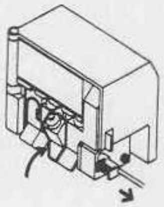
Equipment
Disinfectant; Na+/K+/Ca++ electrode fill solution, Cat.478535

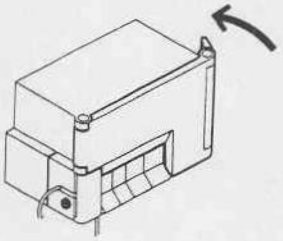
Disinfect and stop the 614 system



CAUTION: Do not use reference electrode fill solution

Unscrew the inner electrode and empty out the solution. Fit a needle to the Na+/K/Ca++ electrode fill solution container, rinse out the electrode and refill to the bottom of the screw thread. Tap the electrode during filling to dislodge air bubbles. Replace the inner electrode - screw down tightly. Shake the electrode down like a thermometer, to dislodge air bubbles at the electrode tip. Wipe the electrode with a dry tissue and check that there is an 'O' ring on the left hand side - fit one if necessary.



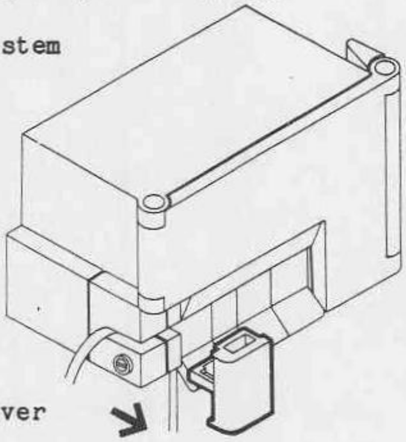


NOTE: Ciba Corning recommend that a deproteinizing and conditioning routine (Section 4.2) is carried out after this procedure.

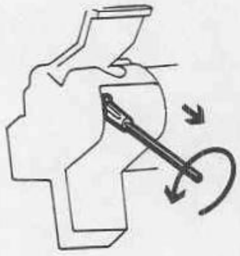
4.12 To Replace the Probe, Probe Tubing and Waste Tube

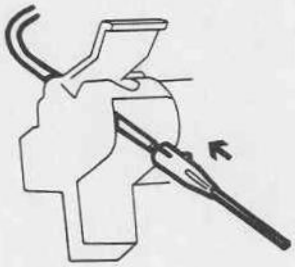
Equipment
Disinfectant; Probe and tubing kit, Cat. 478634.

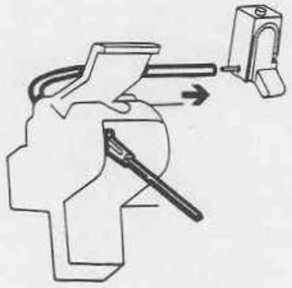
Disinfect and stop the 614 system

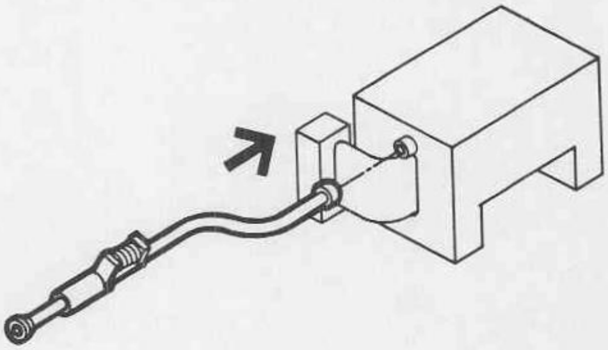


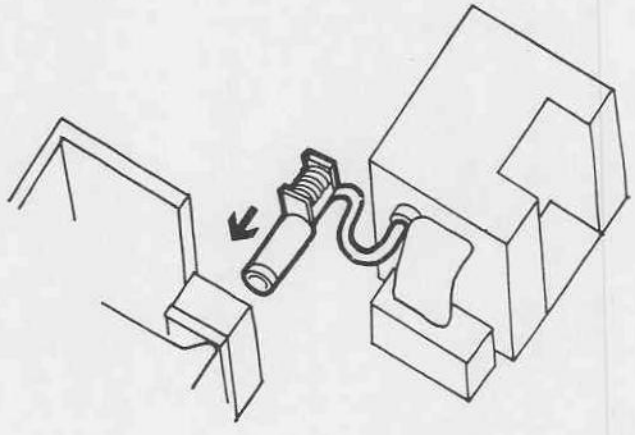
Remove the sample detector cover









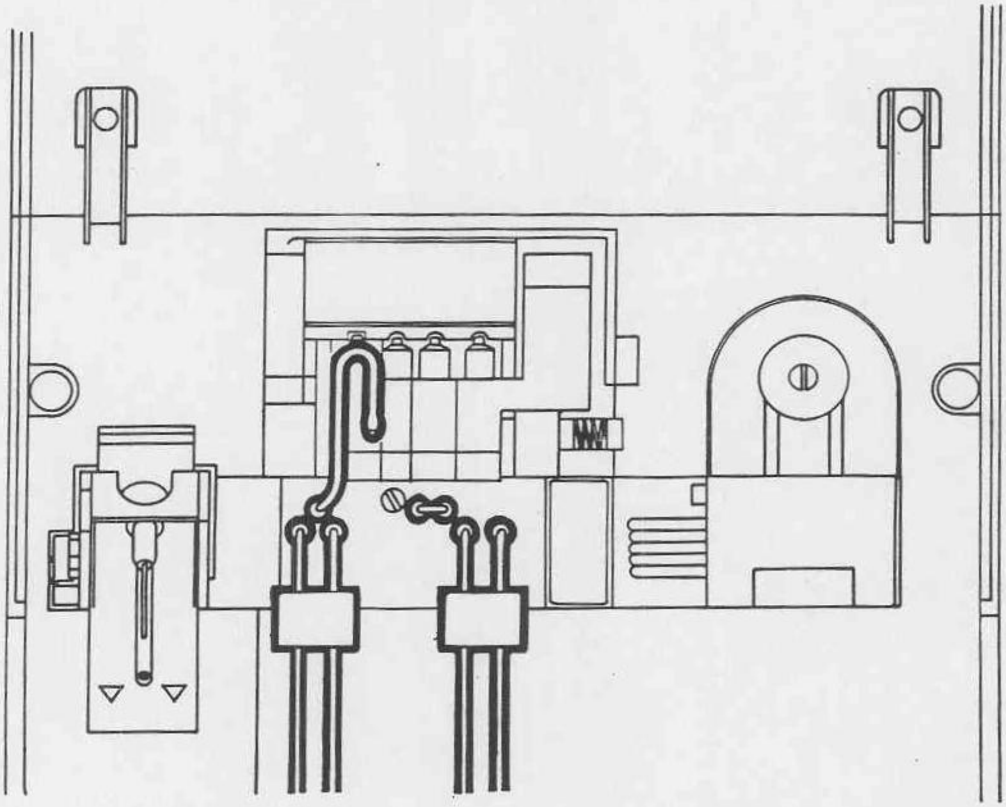


Replace the sample detector cover

4.13 To Replace the Connecting Tubing

Equipment
Connecting Tubing Kit, Cat. 478653

Drain the 614.



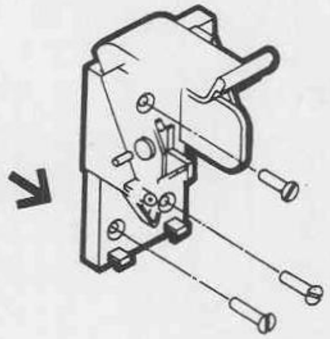
4.14 To Replace the Probe Micro Switch

Equipment
Disinfectant; Screwdriver, supplied with Installation Pack; Micro switch, Cat. 478623.

Disinfect and stop the 614 system.

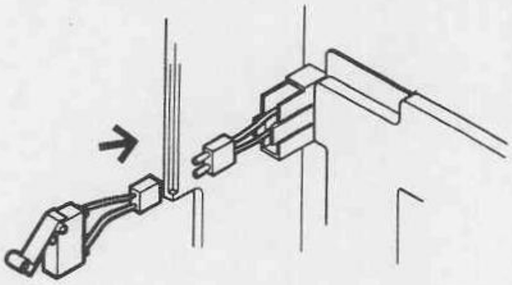
Remove the weir cover, Section 4.6.

Remove the probe and tubing, Section 4.12.



Remove the probe assembly.

If necessary, remove the transit strap from the micro switch connector.



If desired, refit the transit strap.

Replace the probe assembly, probe and tubing and weir cover. Check that the micro switch is operating, Section 5.3, paragraph 4.

4.15 To Replace the Manifold and Solenoids

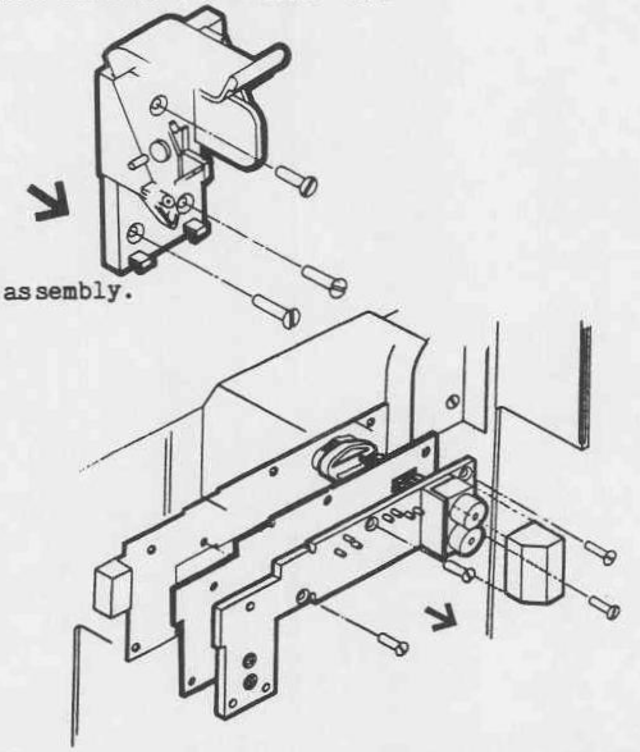
Equipment
Disinfectant; Manifold, Cat. 478841; Solenoid assembly, Cat.478842; Manifold plug, Cat.478825; Manifold gasket, Cat. 478824; as required; Screwdriver, supplied with Installation Pack.

Disinfect and drain the 614.

Remove the weir cover, Section 4.6.

Remove the probe and probe tubing, Section 4.12.

Remove the pump tube cassette. Section 4.9.



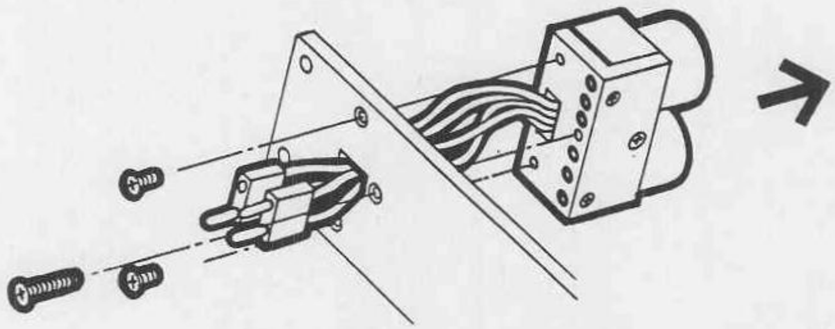
Remove the probe assembly.

Manifold plug

Manifold gasket

Disconnect all tubing from the manifold, and remove the manifold. Remove the manifold plug. If necessary, remove the transit straps from the solenoid connectors, and disconnect.

4.15 To Replace the Manifold and Solenoids (contd)



Remove the solenoid assembly, take care not to lose the '0' rings.

Using new parts as required :

Replace the solenoid assembly on the manifold. Make sure the '0' rings are still fitted.

Feed the connectors through the manifold gasket and reconnect. If desired, refit the transit straps.

Slide the solenoid leads into the manifold plug, and replace the plug.

Replace the manifold.

Replace all tubing (Section 4.13).

Replace the pump tube cassette.

Replace the solenoid cover.

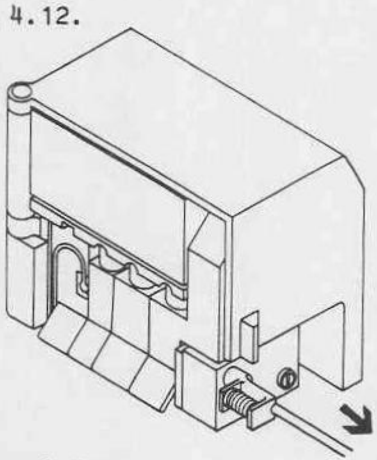
Replace the probe assembly, probe, probe tubing and weir cover. Check that the micro switch is operating, Section 5.3, paragraph 4.

4.16 To Replace the Sample Detectors

Equipment
Disinfectant; Screwdriver, flat blade, small; Sample detector (inlet) Cat. 478673; Sample Detector (outlet) Cat. 478674.

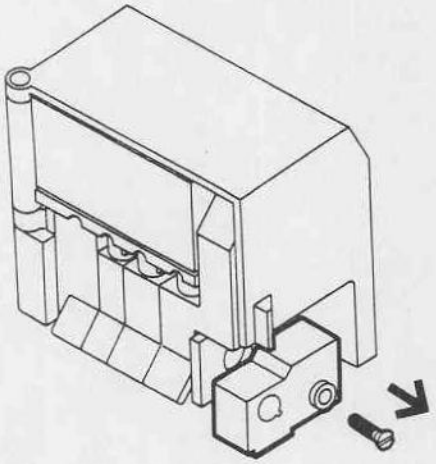
Disinfect and stop the 614 system.

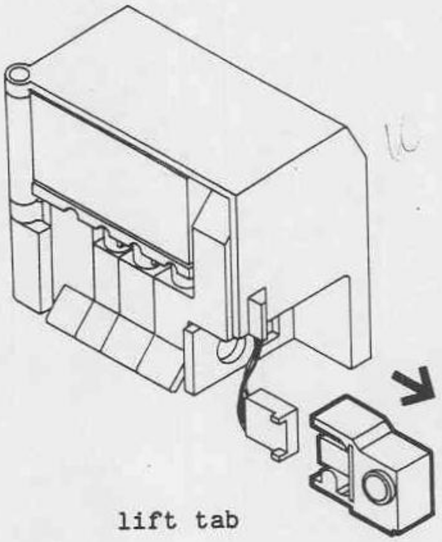
Remove the probe and tubing, Section 4.12.



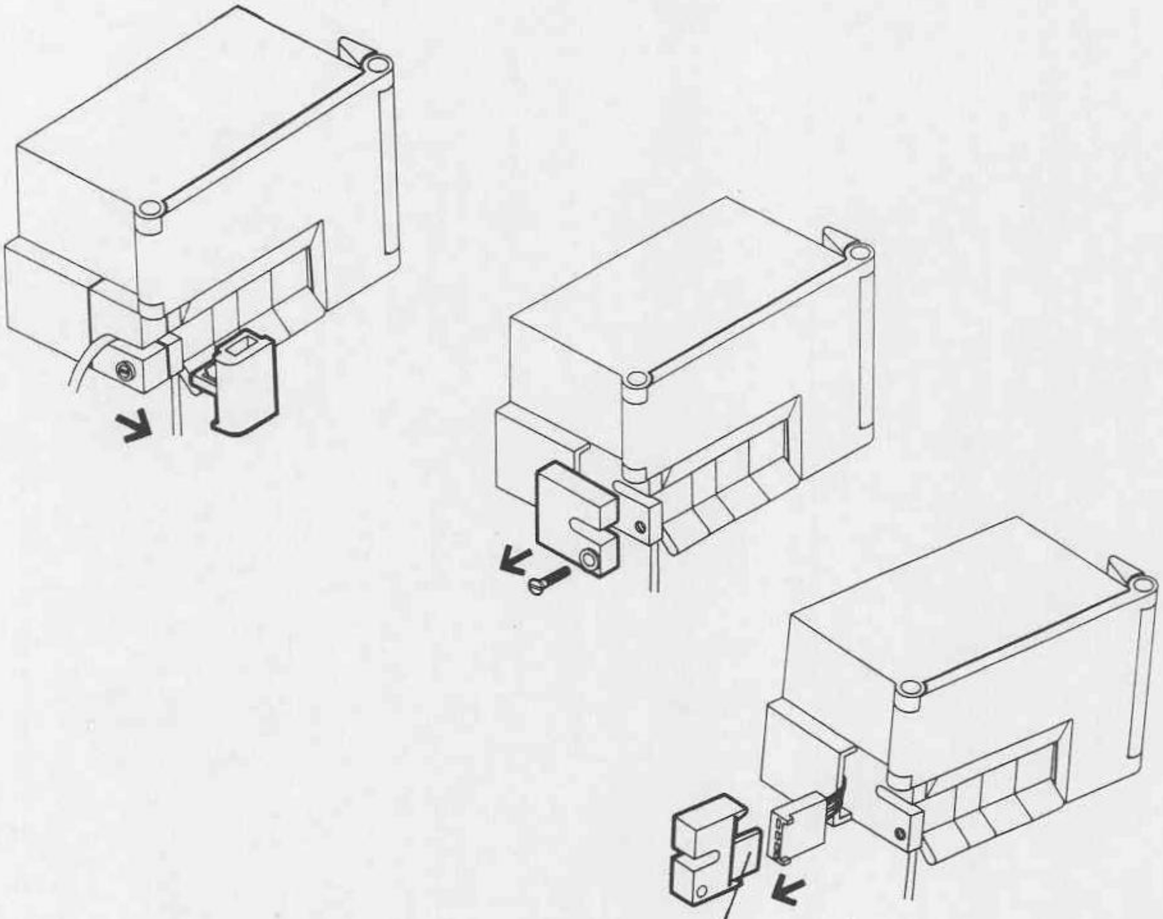
Remove the waste tube and plunger

Remove the pump tube cassette, Section 4.9.





4.16 To Replace the Sample Detectors (contd)

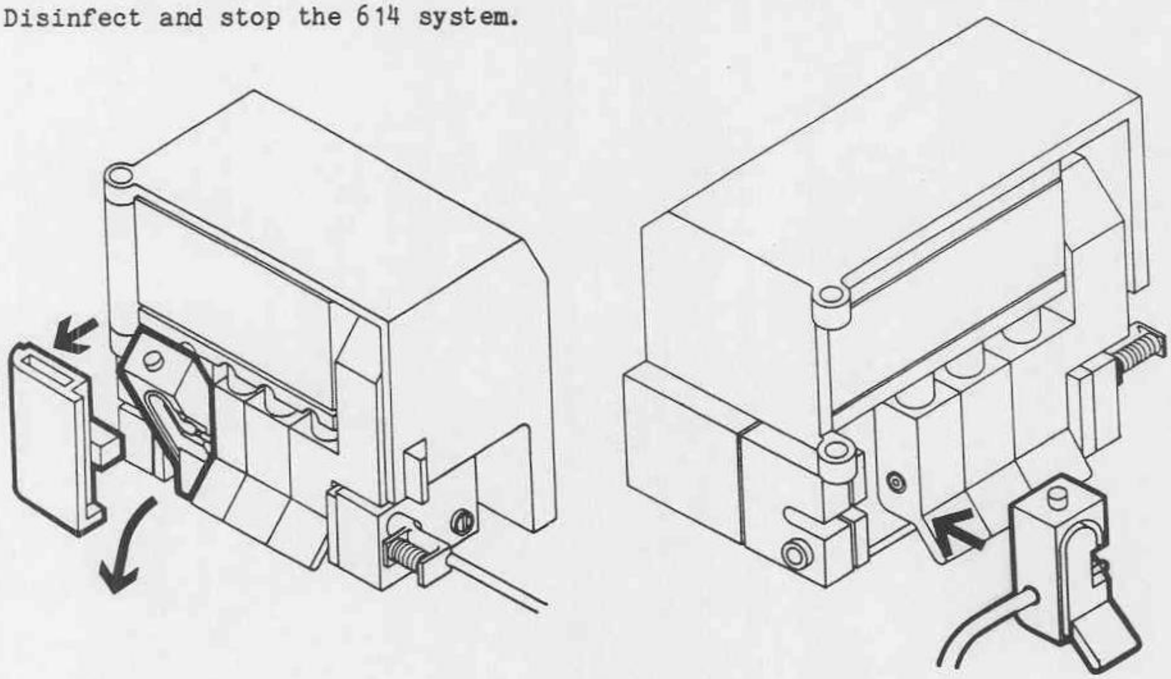


Reassemble in reverse order

4.17 To Replace the Slope Inlet Block

Equipment
Disinfectant; Slope inlet block, Cat. 478542

Disinfect and stop the 614 system.

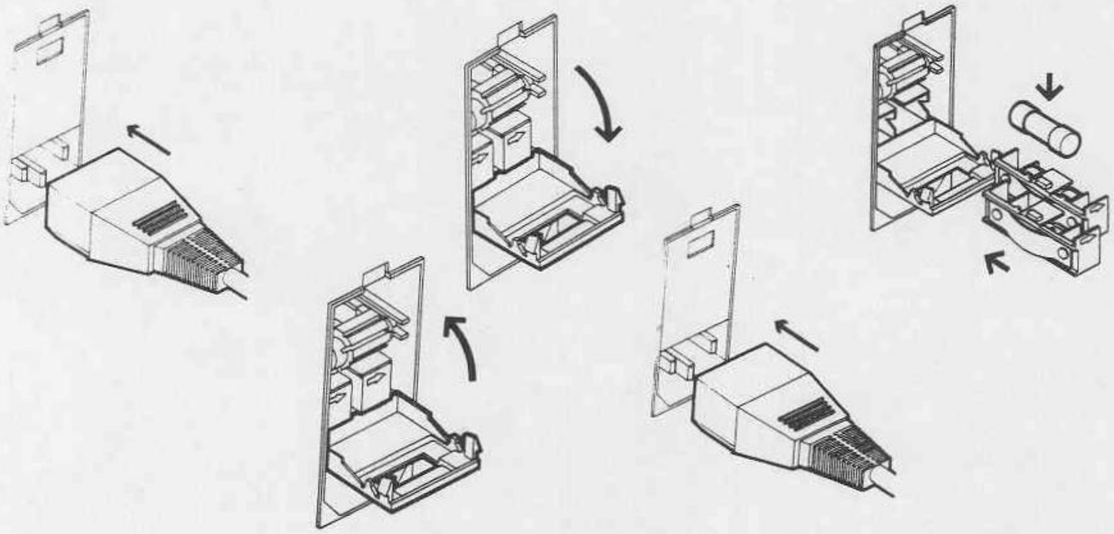


Remove the probe tubing and slope tube from the slope inlet block and fit to the new block.

4.18 To Replace a Fuse

Equipment
Fuses, Cat. 478648

WARNING : For continued protection against fire hazard use only the same type and rating of fuse that was fitted originally to the 614 - refer to instrument rear panel.



Make sure that the voltage selector bobbin is set to the correct voltage for the local power supply.

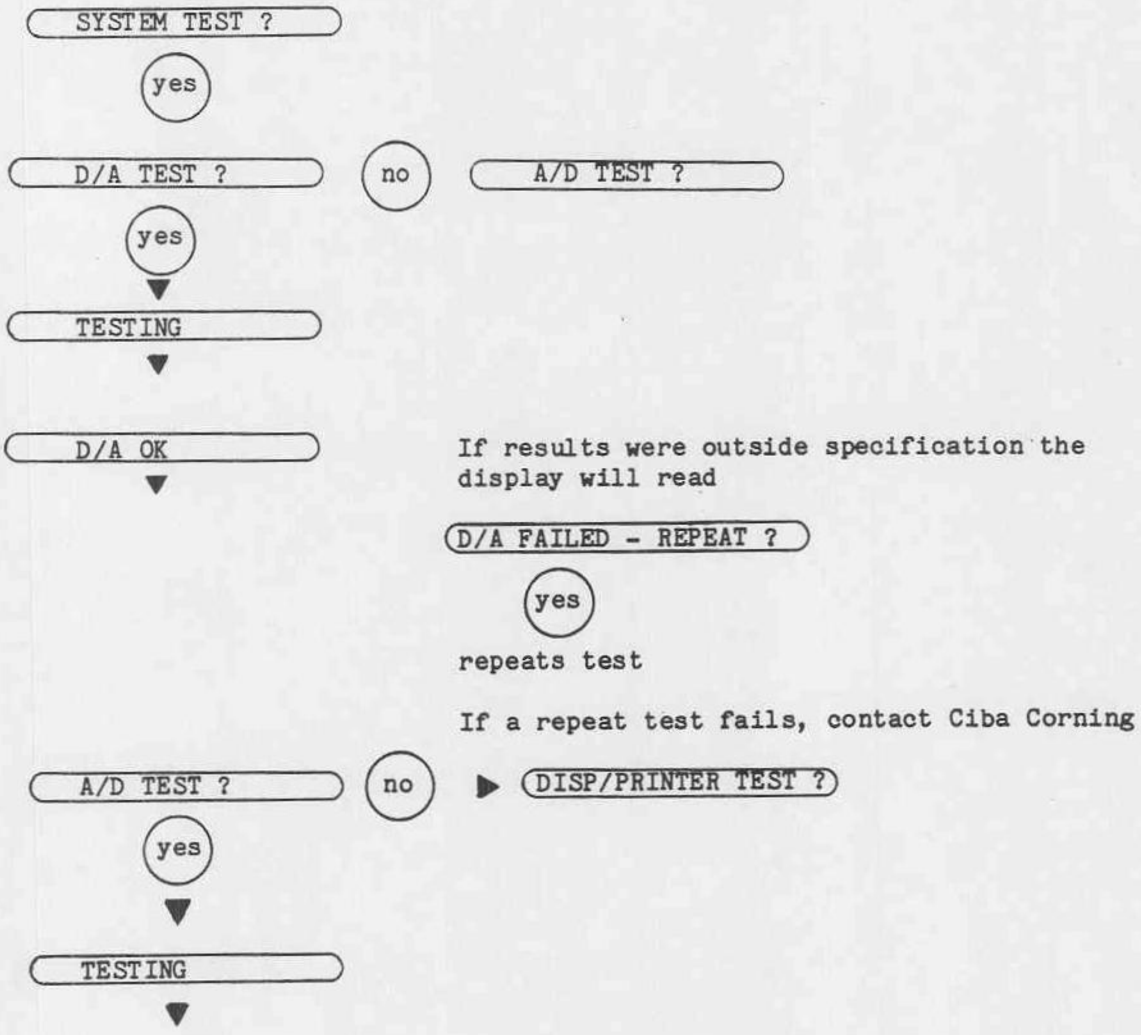
Voltage Selected	Voltage Range
100V	85V to 110V
120V	102V to 132V
220V	187V to 242V
240V	204V to 264V

CAUTION : Do not rotate the voltage selector bobbin when it is fitted in the voltage selector as this will damage the contacts.

4.19 System Test Routine (refer to Appendix C for 634)

This routine allows the user to check the instrument functions. The following test routines are available : D/A converter, A/D converter, display and printer and electrode outputs. If the integral printer is enabled the date, time and result of each test will be printed.

NOTE : The electrode output routine will not be accessible if SYSTEM TEST ? is entered from ANALYZE URINE ?


SYSTEM TEST ?
yes
D/A TEST ?
no
A/D TEST ?
yes
TESTING
D/A OK
D/A FAILED - REPEAT ?
yes
A/D TEST ?
no
DISP/PRINTER TEST ?
yes
TESTING

If results were outside specification the display will read

repeats test

If a repeat test fails, contact Ciba Corning

4.19 System Test Routine (Contd)

▼

A/D OK

▼

If results were outside specification the display will read

A/D FAILED - REPEAT?

yes

repeats test

If a repeat test fails, contact Ciba Corning.

▼

DISP/PRINT TEST ? no ▶ ELECTRODE O/P TEST?

yes

HHHHHHHHHHHHHHHHH

yes or no (or 10 seconds)

IIIIIIIIIIIIIIIII

yes or no (or 10 seconds)

#################

yes or no (or 10 seconds)

ELECTRODE O/P TEST? no ANALYZE BLOOD ?

yes

▼

NOTE : If SYSTEM TEST ? was entered from ANALYZE URINE ? mode the electrode output test routine will not be available.

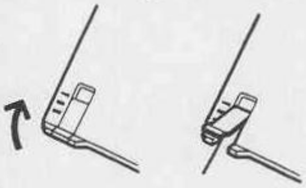
mV MODE ? yes ▶

no

▼

Select the mV mode to check electrode mV output The mmol/L mode can be used to visually monitor electrode signal output.

mmol/L MODE ? yes OPEN PROBE



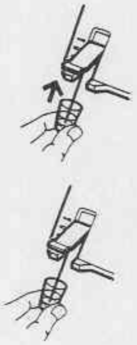
4.19 System Test Routine (contd)

(PROBE IN TEST SOLN?)

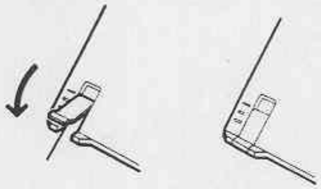
yes

(SAMPLING)
(SAMPLING - WAIT)

▼



NOTE : TEST SOLN in mV mode should be Cal/Flush or slope solution for comparison with mV values given



(RETURN PROBE)

▼

(If the probe is not returned within 10 seconds the tone will sound)

(MEASURING)
(PLEASE WAIT)

▼

(Na=XXX.X K=XXX.X mV)

or

(Na=XXX K=X.XX mmol/L)

▼

The results are displayed and will change as the electrode outputs plateau. After 30 seconds the display is frozen. If in mV mode check that the readings are within:

	Minimum mV	Maximum mV
Cal/Flush	35	100

Slope Na should be between 4.7 and 8.8 mV less than the measured Cal/Flush mV level.

Slope K should be between 13.5 and 19.6 mV more than the measured Cal/Flush mV level.

If the results are outside these ranges, refill the Na+ and K+ electrodes, Section 4.11.

▼

(ELECTRODE O/P TEST ?) yes repeats test

no

(ANALYZE BLOOD ?)

4.20 Pre-service Protocol

Prior to any of the procedures detailed in sections 4.21 to 4.29 being carried out the following steps should be taken :

(i) Select RETURN TO SET-UP? on the display. Press "Yes"

(ii) Wait for Set-up menu to be printed. Retain printout for future reference

(iii) Disconnect instrument from mains electricity supply

(iv) Carry out service procedure

(v) Perform post service protocol (Section 4.30)

4.21 To Replace the CPU Board Cat.No. 478678

Remove the seven screws holding the rear panel in place. Lay down the rear panel. Remove connectors from PL2, PL3 and PL6. Remove the ribbon cable connector from PL10 on the power supply board. Unscrew the four nuts holding the CPU board in place (EV3). Unscrew the four hexagonal retainers associated with the 'D' type connectors (EV3 ref. no. 98). Lift out the CPU board. Replace the board by carrying out the above steps in reverse order.

When replacing the CPU board care should be taken to ensure that the correct language option and instrument software is maintained. The spare CPU board is shipped as an English/Spanish option. The replacement should be handled as follows :

614 English/Spanish	-	Direct replacement of CPU board
614 English/French } 614 English/German } 614 Englsh/Japanese }	-	Remove IC3 from the CPU board in the instrument and exchange it for IC3 in the spare CPU board

N.B. The CPU board is a multilayer board and repair of the board should only be carried out by qualified personnel. It is recommended that faulty boards should be returned to Ciba Corning or their distributors for repair.

4.22 To Replace the Power Supply Board Cat.No. 478677

First remove the rear panel as described in 4.20. Remove the connectors from PL7, PL8, PL9, PL10 and PL11. Remove the screw at the left hand rear corner (viewed from the rear) of the board. Remove the large screw in the centre of the heatsink attached to the right hand panel (viewed from the rear) of the instrument. The board can then be removed by sliding out to the rear of the instrument. Refitting the board is achieved by carrying out the above steps in reverse order.

4.23 To Replace the Amplifier Board Cat.No. 478679

First remove the rear panel as described in 4.20. Remove the connectors from PL12, PL14 and PL15 and the four electrode leads. Remove the ribbon cable connector from PL3 on the CPU board. Unscrew the two retaining screws and remove the board (the two screws will be retained in the board). Refitting the board is achieved by carrying out the above steps in reverse order.

4.24 To Replace the Transformer Assembly Cat.No. 90416032A

First remove the rear panel as described in 4.20. Remove the connector to the power board (PL7). Unscrew the two screws either side of the voltage selector and the four screws securing the transformer to the base plate. Refitting the transformer is achieved by carrying out the above steps in reverse order.

If a new transformer assembly is fitted ensure that the voltage selector is set to the correct voltage and that fuses are in place. (Refer to Section 2.3)

4.25 To Replace the Electrode Door Assembly Cat.No. 90416031P

Lift the door to its upright position. Remove the screw in the cover over the braid connection (EV2 ref. 51). Place the cover and dome washer to one side. Remove the two screws holding the door to the hinges and remove the door. When replacing the door, check the alignment by closing the door and adjust as necessary. Replace the braid, dome washer and braid cover.

4.26 To Replace the Display Board Cat.No. 478656

First remove the rear panel as described in 4.20. Unscrew the two long screws inset in the top of the instrument case. Unscrew the two screws inside the case. Pull the panel and cover forward. Disconnect the braid connected to the screen behind the display and the braid connection to the front panel. Remove the four screws holding the display screen in place. Remove the display screen. Disconnect the display from the interconnection cable and remove it. Replace the display board and reassemble the screen and attach the braids before refitting the display panel.

4.27 To Replace the Printer Assembly Cat.No. 478661

First remove the display cover as described in 4.25. Detach the printer support plate by unscrewing the three nuts holding it in place. Disconnect the printer from PL8 of the power board. Remove the printer assembly. Remove the printer from the printer support plate. Replace the adhesive pads on the plate and attach the new printer to the plate. Reassemble the printer in place and refit the display cover.

4.28 To Replace the Motor/Gearbox Assembly Cat.No. 478666

First remove the rear panel as described in 4.20. Then remove the rotor assembly as described in 4.9. Remove the transit strap from the two halves of the in-line connection for the motor. Unplug the motor and unscrew the two screws at either side which retain it in place. Pull the motor out. Refit the new motor/gearbox assembly by following the above steps in reverse order.

4.29 To Replace the Electrode Block Assembly Cat.No. 478828

First remove the rear panel as described in 4.20. Remove the sample detectors from the block. Remove the amplifier board as described in 4.22. Unscrew the four screws retaining the block assembly in place. Remove the block assembly from the front. Remove electrodes from the block and refit new block by reversing the above procedure.

4.30 Post-Service Protocol

On completion of any of the procedures described in sections 4.21 - 4.29 the following steps should be taken :-

(i) Reconnect the instrument to the mains electricity supply

(ii) If a warm start occurs, allow the instrument to calibrate. When it displays ANALYZE BLOOD? select the RETURN TO SET-UP? option, press "Yes" and allow the set-up menu to be printed. Check that the menu is the same as obtained prior to the service being carried out.

(iii) If a cold start occurs, enter the correct data and time values and input data which corresponds to the menu as set prior to the service.

(iv) When the instrument returns to "ANALYZE BLOOD?" measure three levels of QC (Certain ISE) and check that the results are correct.

(v) Initiate a 2 point standardization.

(vi) Measure 10 replicates of a serum sample and check that the CV is within the instrument specification.

(v) Initiate a 2 point standardization

5 TROUBLESHOOTING

5.1 General

Section 6.1 of the Instruction Manual has complete troubleshooting charts. The information in this section describes aids to troubleshooting and some recommended procedures to remedy certain problems which may occur.

5.2 Power Supply Checks

Basic indications of whether the main power supplies are functioning can be derived from the status control LEDs (refer to section 5.3.1).

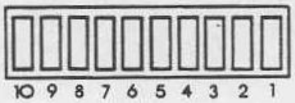
The following checks are carried out on the Power PCB. All voltages are measured with respect to 0V. (A convenient point is the negative connection of C16)

Voltage	Test Point	Reading
+ 5V	C27 +	+ 4.75 to + 5.25
+ 12V	D17 +	+ 11.50 to + 12.50
- 12V	C21 -	- 9.6 to - 14.4
+ 6V	IC2 pin 1	+ 5.8 to + 6.2
- 6V	IC2 pin 8	- 5.8 to - 6.2
+ 25V	C17 +	+ 19.2 to + 28.8

5.3 Status Indicator Checks

The status indicators are under the plastic cover on the rear panel.

LED Number	Check
1	a.c. power secondary
2	+12V
3	+5V
4	-5V
5	cal/flush solenoid
6	microprocessor
7	slope solenoid
8	peristaltic pump motor
9	not used
10	micro switch



5.3.1 Check that LEDs 1 to 4 are on. If any are dim or off it indicates a failure of that power supply. If the check in Section 5.2 was successful then there is probably an interconnection failure between the Power and CPU boards.

5.3.2 Check that LED 6 is flashing. This indicates that the microprocessor is functioning. If it is not flashing disconnecting and reconnecting the power should restore normal operation. If this action does not rectify the problem, there is a fault with the CPU board.

5.3.3 Perform a manual 2 point standardization. During this routine LEDs 5 and 7 should come on and go off. LED 8 should come on/go off/change brightness. Failure of any of these LEDs indicates a failure of the associated drive circuitry of the solenoids or the pump motor.

5.3.4 Raising and lowering the sample probe should cause LED 10 to come on/go off in synchronisation with the probe movement. Failure of this indicates a probable microswitch failure.

5.4 Electrode Test Simulator

During troubleshooting it may be difficult to distinguish between electrode and electronic problems. If this is the case, the Electrode Test Simulator (part no. 478723) can be used to aid in troubleshooting. Instructions for use are as follows :

The test set simulates the mV output of the electrodes and can be used to simulate a sample, a calibration routine (one point or two point), or the mV/mmol readings in the electrode test routine.

Methods of Use

a) Installation

Remove the electrodes and the slope block from the 614. Reinstate the sample flow path using the enclosed T piece and tubing (ensure the tubing passes through the blood detectors).

Plug the contact strip into the front of the electrode block - the pins fit above the electrode contacts, between the contacts and the electrode block.

b) Procedures

When using the test set it should first be used to perform a 2 point calibration.

2 Point Calibration Simulation

Install the test set as previously described

Set the test set selector switch to "Cal"

Initiate a two point calibration procedure on the 614 (calibrants will be required to operate the optical detectors)

Wait until the "CALIBRATION OK" message is displayed

Set the test set selector switch to "Slope"

Wait until the "SLOPE OK" message is displayed

The 614 is now calibrated with the test set as its 'electrodes'

Sample Simulation

Ensure "ANALYZE BLOOD?" is displayed on the 614

Install the test set as previously described

Select the "Cal" or "Slope" mode on the test set

Initiate a sample routine on the 614 (a sample will be required to operate the optical detectors)

When the 614 has endpointed the display reading will depend on the slope and intercept values entered in memory, but should be consistent if two or more consecutive sample simulations are run.

Electrode Test Simulation

Install the test set as previously described

Initiate the electrode test routine

If mV selected -

When the 614 has endpointed the display will read :

(i) With test set switched to "Cal"

Na within the range 50 to 100 mV (Result A)
K within the range 50 to 100 mV (Result B)

ii) With test set switched to "Slope"

Na	Result A	- 6 mV
K	Result B	+ 17 mV

If mmol selected -

When the 614 has endpointed the display will read :

Na = 140 K = 4.00 mmol/L with test set switched to "Cal"
Na = 110 K = 8.00 mmol/L with test set switched to "Slope"

Note - the display will only read the above figures if a two point calibration has been performed using the test set. If a two point calibration has not been performed the display and mmol/L results will be dependant on the difference in output between the test set and the instrument's own electrodes.

5.5 Hydraulic Test Simulator

In order to exercise the hydraulic system of the instrument to determine the cause of the problems the use of this test simulator (part number 478567) can help. Instructions for its use are as follows :

The functions the test set enables the user to check are :-

a) Solenoid operation/solution path
b) Pump operation
c) That the RS232 outputs data

Warning - Hazardous potentials are present on the mains input socket, therefore care should be taken when using this test set.

Methods of Use

1. Installation

   a) Remove power from the instrument
   b) Unscrew rear panel and connect the test set plug to the data output socket
   c) Remove test set cover (push in direction of 'open' pointer).
   d) Disconnect the molex connector with cableforms going to the solenoids and pump, and connect it to the test set molex connector.

2) Procedures

Pump Operation

a) Power up instrument
b) The 20 mA LED on the test set should illuminate
c) Switch test set pump control to 'OFF'. The pump should now be stationary
d) Switch test set pump control to 'ON'. The pump should now rotate at a slow but constant speed

RS232 Check

a) Power up instrument
b) The 20 mA LED on the test set should illuminate
c) Whatever status the instrument is in - step through the menu to 'RETURN TO SET UP'
d) Press 'YES'
e) Print out of set-up menu will occur. (Note if DMS mode A is already selected the 20mA and RS232 LED will flash during print out.
f) Select DMS Mode A
g) Exit set-up menu - the 20 mA and RS232 LEDs will flash during printing

Solenoid Operation/Solution Path

a) 'Power up' instrument
b) Switch 'solenoid control' to 'OFF'. The solution path should now be from A to F and H to D.
c) Switch 'solenoid control' to 'Cal'. The solution path should be from A to G.
d) Switch 'solenoid control' to 'Slope'. The solution path should be from H to I.

Note - A,D,F,G,H and I refer to the tubing ports as detailed in Figure 6

3. On Completion of Test

a) Disconnect mains
b) Unplug molex connector from test set, clip test set cover back in place
c) Connect molex connector to its original connector on the I/O board
d) Reassemble rear panel on the instrument ensuring that all of the fixing screws are secure

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5.6 Troubleshooting Hints

5.6.1 Electrode Problems

If there are problems with electrodes, i.e. unstable readings or out of range readings a series of steps should be taken :

(a) Visually inspect the whole electrode area for signs of KCl leakage. Remove the electrodes and ensure that no leaks have occurred resulting in alternative conductive paths for signals. Examine the electrode contacts for signs of corrosion.

(b) Remove any bubbles from the Reference Electrode. This can be done by tapping or shaking the electrode to manipulate the air bubble into the cassette chamber. The bubble can also be removed by unscrewing the nafion inner by means of the small hexagonal tool in the electrode box and allowing KCl solution to flow up and displace the bubble.

(c) If the previous two steps are unsuccessful and the Na and K electrodes have sufficient fill solution in them, then deproteinizing and conditioning should be carried out (see Section 4.2).

Note - After deproteinizing and conditioning the electrodes may take up to 2 hours to return to stable operation.

(d) The electrode O/P test option should be used to determine if the electrodes are performing within specification. (See section 4.19). Large negative millivolt readings are usually indicative of bubbles in the reference electrode. If the electrode O/P test results indicate satisfactory electrode performance and the standardization of the instrument is persistently failing then the problem is probably hydraulic.

(e) Frequent occurrences of unstable readings can be due to bad earth connections to the electrode door. Continuity between the main earth stud on the base plate and the electrode door should be checked. N.B. The door must remain closed in normal operation.

(f) If none of the above steps resolves the difficulties, use of the electrode test simulator can determine if the problem is an electronics or electrode/hydraulics failure.

5.6.2 Hydraulics Problems

Hydraulics problems can usually be categorized as follows :

a) Cal solenoid failure - will be indicated by lack of solution delivered to the weir (or continuous delivery of solution to the weir).

b) Slope solenoid failure - indicated by no slope solution or continuous slope solution delivery. The latter instance will manifest itself by solution coming out of the probe.

c) Pump tube cassette failure - this can be seen in a number of ways. Insufficient delivery of cal, slope or sample solution during the relevant parts of the hydraulic sequences is the main evidence for pump tube cassette failure.

N.B. The pump tube cassette is a consumable and should be replaced at regular intervals (typically 3 monthly).

d) Leaks - these can usually be detected by visual inspection.

e) Blockages - when blockages are discovered they can be cleared as described in section 4.7.

Use of the hydraulic test simulator should ease the determination of hydraulic problems.

5.6.3 Electronic Problems

Electronic problems should normally be corrected by replacement of PCBs. Attempted repair of PCBs is not recommended as the boards are high density, multi layer PCBs.

6.1 Ordering Information

When ordering spares or accessories for the 614, please give the following information to your Ciba Corning distributor :

614 Serial Number
Catalog Number of Part (Cat.)
Description
Quantity Required

This will make sure that your order is dealt with quickly and efficiently.

The number shown in the third column (Quantity) is the quantity of items that are supplied against the stated Catalog Number. If the quantity is greater than 1, the only multiples of that quantity can be supplied.

6.2 Engineers Spares Kit

The following is the Engineers Spares Kit for the 614 (serial numbers 2000 upwards) :

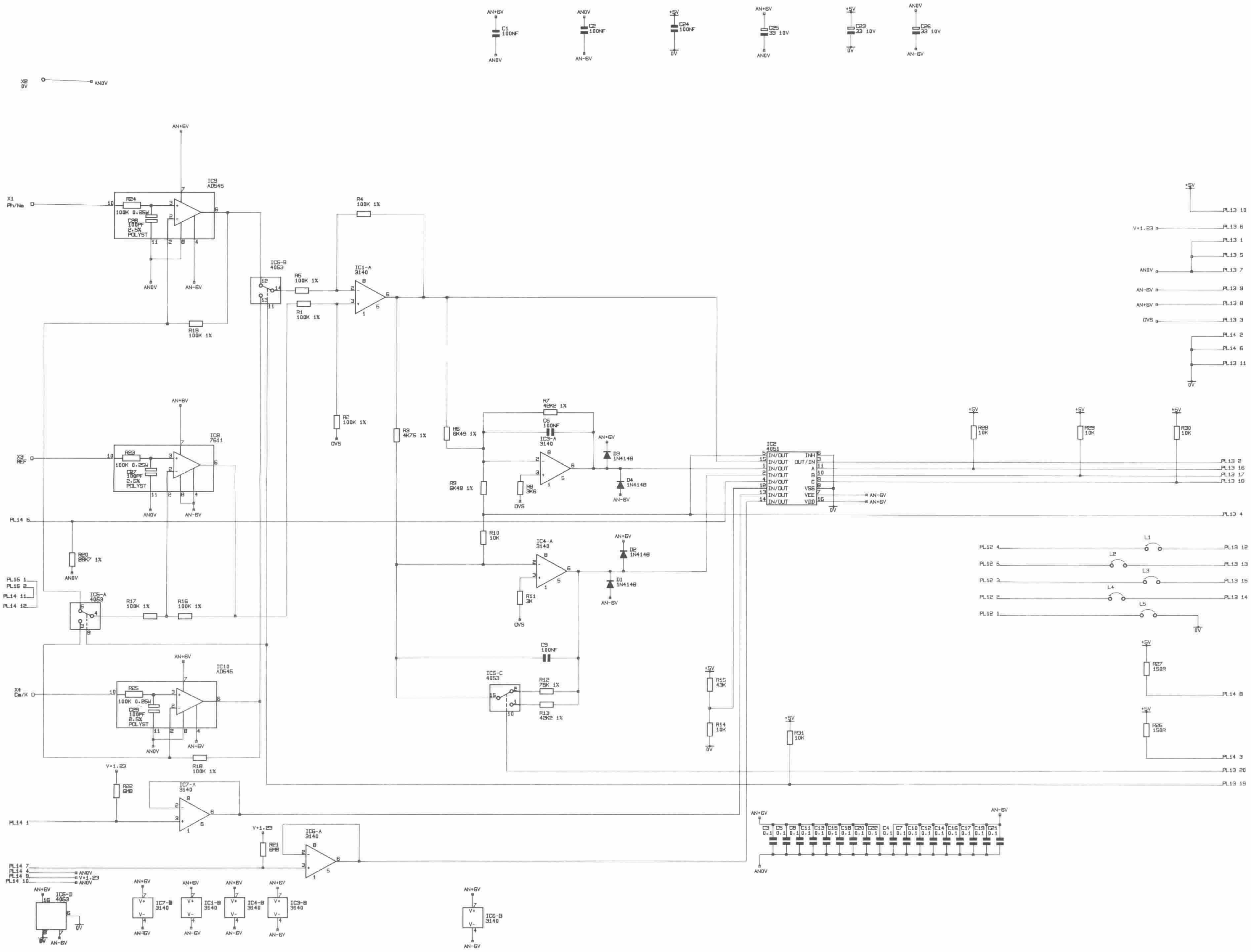
Cat No.	Description	Quantity
478840	Engineers Spares Kit 614	1
containing -		
478822	Reference Electrode Solution	1 pack of 4
478498	Reference Electrode Refill	1
478509	Reference Electrode Inner & KCl	1
476270	K+ Electrode	1
476266	Na+ Electrode	1
478535	Na+/K+/Ca++ Fill Solution	1
478536	Security Key	1
478542	Slope Inlet Block	1
478623	Probe Microswitch	1
478624	Printer Paper Spindle	1
478633	Weir Cover	1
478634	Probe & Tubing Kit	1
478841	Manifold Perspex	1
478842	Solenoid Assembly (NR)	1
478824	Manifold Gasket	1
478825	Manifold Plug	1
478637	Printer Ribbon Cassette	2
478638	Printer Paper	1 pk of 2 rll
478639	Pump Tube Cassette	2
478645	Clot Removal Line	1
478648	Fuse Pack (2 x 1A slo-blo)	1

Cat No.	Description	Quantity
478775	Solenoid Cover	1
478826	Fuse Pack (3 x 3A Slo-blo)	1
478653	Connecting Tubing Kit	1
478654	Probe Lever	1
478656	Display Board	1
478657	Manifold Mounting Plate	1
478661	Printer Kit	1
478662	Thermistor Kit	1
478828	614 Electrode Block Assembly	1
478664	Rotor Kit	1
478666	Motor/Gearbox Kit	1
478678	CPU PCB	1
478677	PSU PCB	1
478679	Amplifier PCB	1
478673	Inlet Sample Detector	1
478674	Outlet Sample Detector	1
478694	Printer Cover	1
478700	Deproteinizing Solution	1 pack of 5
478701	Conditioning Solution	1 pack of 5
478835	Service Manual	1
478829	Probe Mount Moulding	1
478830	Hardware	1 pack
478831	Marine Sealant	1
478949	Silicone Grease	1
478836	PROM Kit English/Spanish	1) Select 1
478837	PROM Kit English/German	1) option
478838	PROM Kit English/French	1) when
478839	PROM Kit English/Japanese	1) ordering
478832	Display C/F	1
478833	Main C/F	1
478834	Power C/F	1

When ordering an Engineers Spares Kit please specify which dual language option is required.

6.3 Other Spares

478723	Electrode Test Simulator
478567	Hydraulic Test Simulator
478677	Power PCB (packaged)
478678	CPU PCB (packaged)
478679	Amplifier PCB (packaged)



AN+6V
C1
100NF
ANØV
ANØV
C2
100NF
AN-6V
+5V
C24
100NF
ØV
AN+6V
C25
33 10V
ANØV
+5V
C23
33 10V
ØV
ANØV
C26
33 10V
AN-6V
X2
ØV
ANØV
X1
Ph/Na
R24
100K 0.25W
C30
100PF
2.5%
POLYST
IC9
AD545
AN+6V
ANØV
AN-6V
R19
100K 1%
IC5-B
4053
R5
100K 1%
R1
100K 1%
R4
100K 1%
IC1-A
3140
R2
100K 1%
OVS
R3
4K75 1%
R6
8K49 1%
R9
8K49 1%
R7
40K2 1%
C6
100NF
IC3-A
3140
R8
3K6
OVS
D3
1N4148
D4
1N4148
AN+6V
AN-6V
R10
10K
IC4-A
3140
R11
3K
OVS
D2
1N4148
D1
1N4148
AN+6V
AN-6V
C9
100NF
IC5-C
4053
R12
75K 1%
R13
40K2 1%
X3
REF
R23
100K 0.25W
C27
100PF
2.5%
POLYST
IC8
7611
PL14 5
R20
28K7 1%
PL15 1
PL15 2
PL14 11
PL14 12
IC5-A
4053
R17
100K 1%
R16
100K 1%
X4
Ca/K
R25
100K 0.25W
C29
100PF
2.5%
POLYST
IC10
AD545
R18
100K 1%
V+1.23
R22
6M8
IC7-A
3140
PL14 1
V+1.23
R21
6M8
IC6-A
3140
PL14 7
PL14 4
PL14 9
PL14 10
ANØV
V+1.23
ANØV
IC5-D
4053
ØV
AN-6V
IC7-B
3140
IC1-B
3140
IC4-B
3140
IC3-B
3140
IC6-B
3140
V+
V-
IC2
4051
IN/OUT
OUT/IN
INH
A
B
C
VSS
VEE
VDD
AN-6V
AN+6V
+5V
R28
10K
R29
10K
R30
10K
PL13 2
PL13 16
PL13 17
PL13 18
PL13 4
+5V
R15
43K
R14
10K
ØV
+5V
R31
10K
PL13 20
PL13 19
PL13 10
V+1.23
PL13 6
PL13 1
PL13 5
ANØV
PL13 7
AN-6V
PL13 9
AN+6V
PL13 8
OVS
PL13 3
PL14 2
PL14 6
PL13 11
ØV
L1
L2
L3
L4
L5
PL12 4
PL12 5
PL12 3
PL12 2
PL12 1
PL13 12
PL13 13
PL13 15
PL13 14
ØV
R27
150R
PL14 8
R26
150R
PL14 3
AN+6V
AN-6V
C3
C5
C8
C11
C13
C15
C18
C20
C22
C4
C7
C10
C12
C14
C16
C17
C19
C21
0.1
ANØV

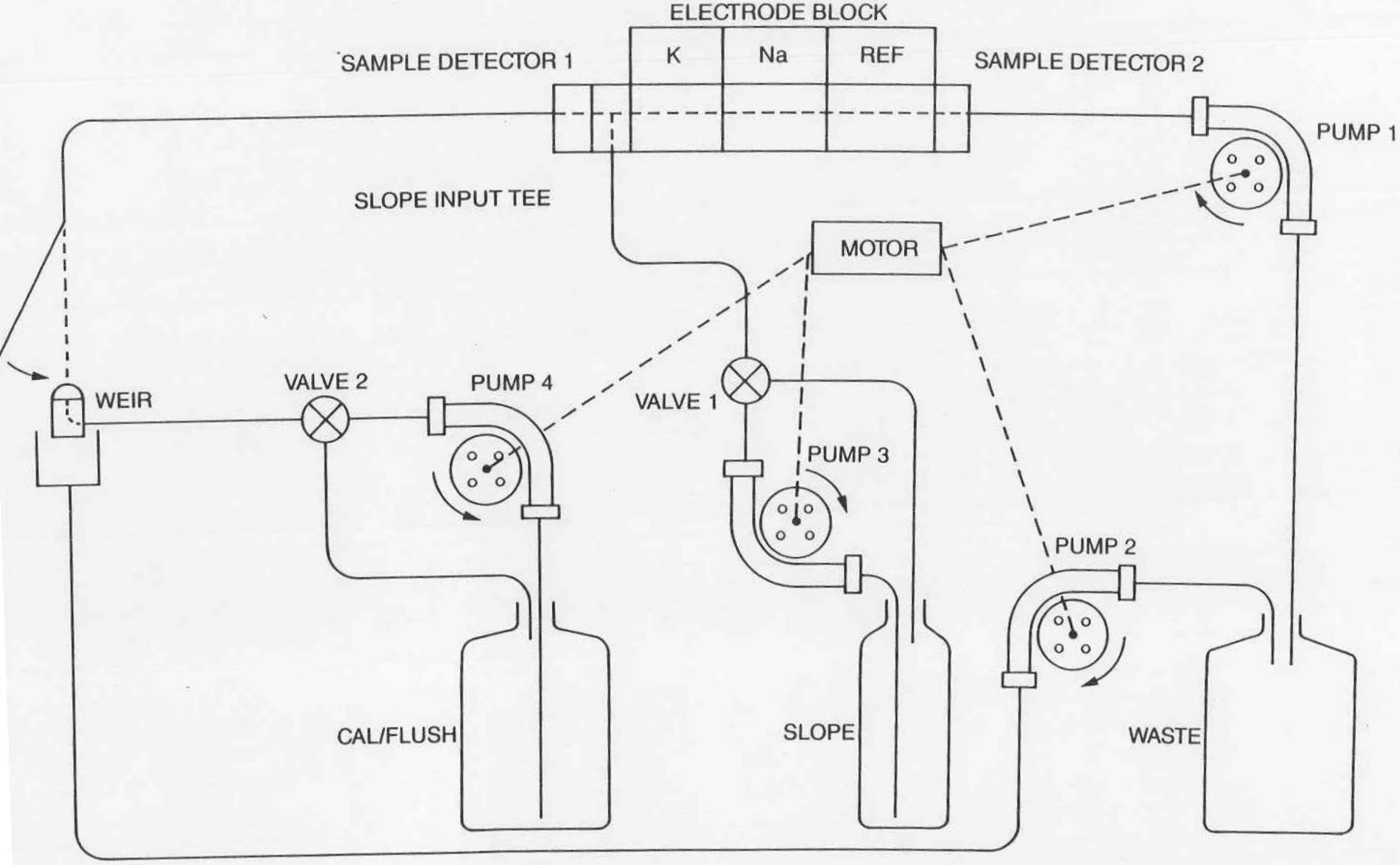

ELECTRODE BLOCK
K
Na
REF
SAMPLE DETECTOR 1
SAMPLE DETECTOR 2
PUMP 1
SLOPE INPUT TEE
MOTOR
WEIR
VALVE 2
PUMP 4
VALVE 1
PUMP 3
PUMP 2
CAL/FLUSH
SLOPE
WASTE

Figure 1a - Hydraulics Block Diagram

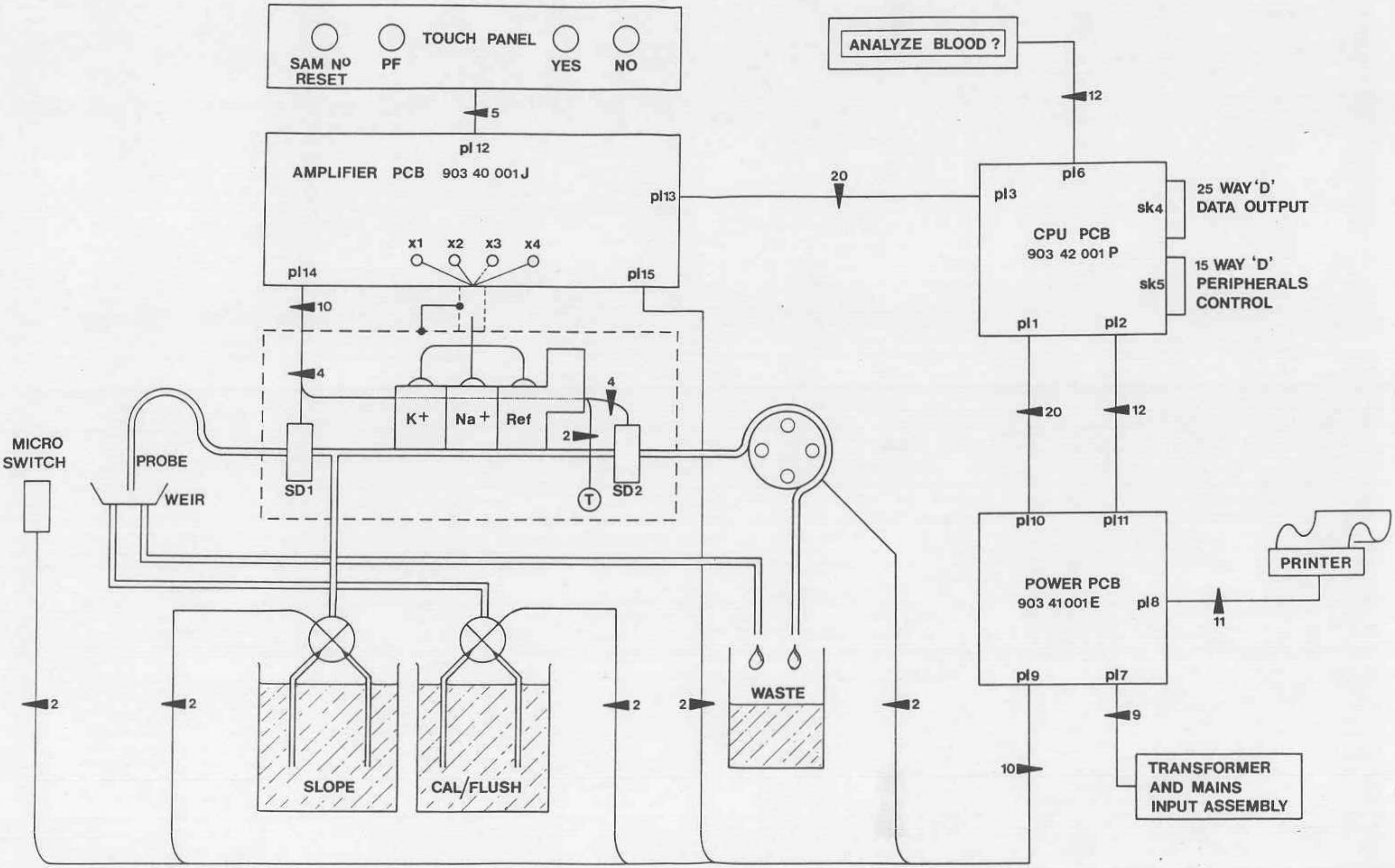
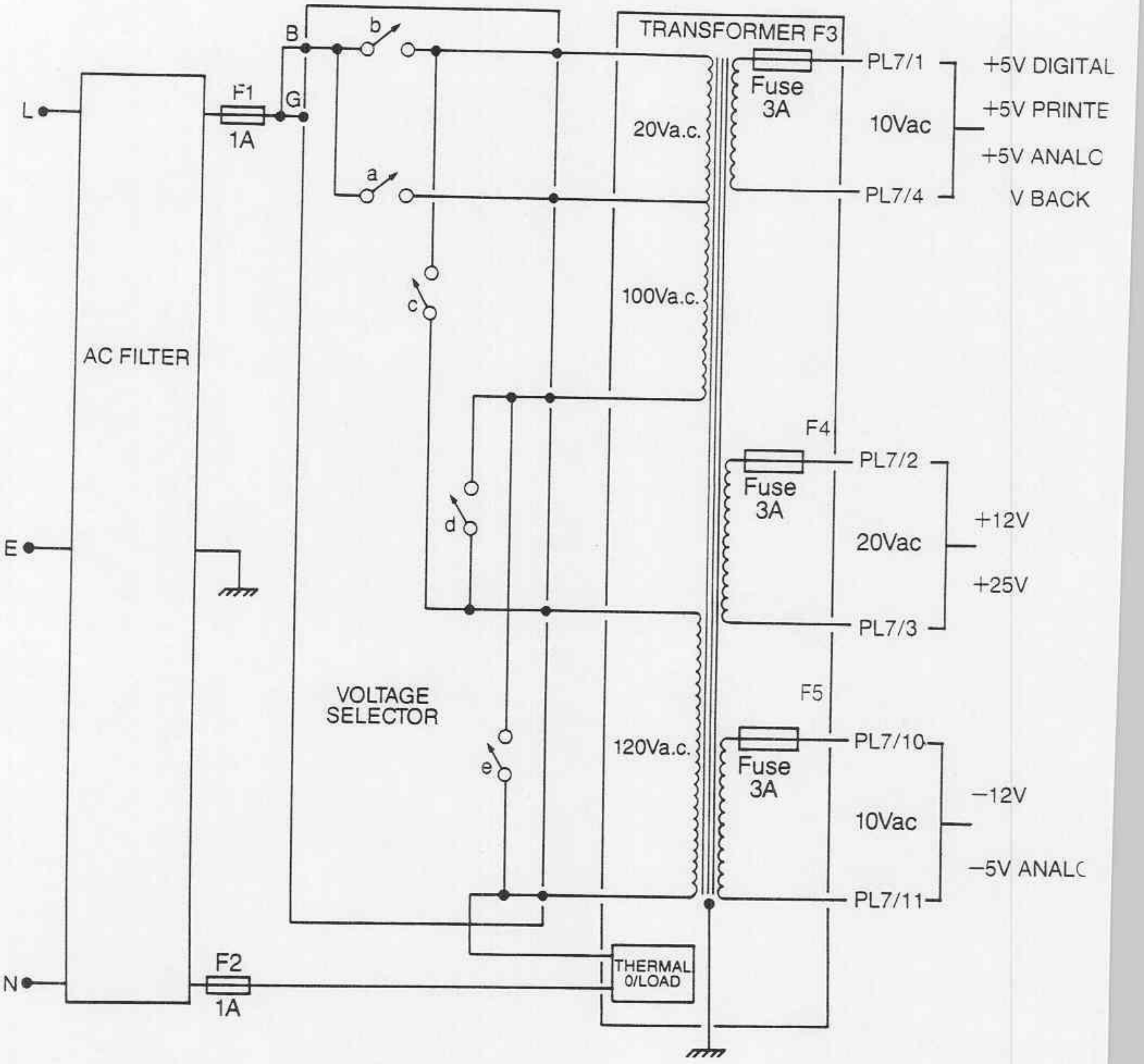

TOUCH PANEL
SAM Nº RESET
PF
YES
NO
5
pl 12
AMPLIFIER PCB 903 40 001 J
pl13
x1
x2
x3
x4
pl14
pl15
10
4
4
2
K+
Na+
Ref
SD1
SD2
T
MICRO SWITCH
PROBE
WEIR
ANALYZE BLOOD ?
12
20
pl6
pl3
sk4
25 WAY 'D' DATA OUTPUT
CPU PCB
903 42 001 P
sk5
15 WAY 'D' PERIPHERALS CONTROL
pl1
pl2
20
12
pl10
pl11
POWER PCB
903 41 001 E
pl8
11
PRINTER
pl9
pl7
9
10
TRANSFORMER AND MAINS INPUT ASSEMBLY
WASTE
SLOPE
CAL/FLUSH
2
2
2
2
2

FIG Ib : 614 BLOCK DIAGRAM

Figure 2 - A.C. Power Supplies


TRANSFORMER F3
B
b
G
F1
1A
L
a
20Va.c.
Fuse
3A
PL7/1
+5V DIGITAL
+5V PRINTE
10Vac
+5V ANALC
PL7/4
V BACK
c
100Va.c.
AC FILTER
F4
Fuse
3A
PL7/2
d
20Vac
+12V
E
+25V
PL7/3
VOLTAGE
SELECTOR
F5
120Va.c.
Fuse
3A
PL7/10
e
10Vac
−12V
−5V ANALC
PL7/11
THERMAL
0/LOAD
F2
N
1A

NOTES: 1 THE SWITCHES 'a' TO 'e' ARE OPERATED BY THE VOLTAGE SELECTOR. THERE ARE FOUR POSSIBLE VOLTAGE SETTINGS AND THE CLOSED SWITCHES FOR EACH VOLTAGE ARE SHOWN BELOW. THE SWITCHES ARE CLOSED BY THE 'FINGERS' ON THE SELECTOR 'BOBBIN' WHEN IT IS INSERTED INTO THE VOLTAGE SELECTOR.

100V	a	c	e
120V	b	c	e
200V	a	d	
240V	b	d	

2 F1 AND F2 ARE INCLUDED IN 478648
F3, F4 AND F5 ARE INCLUDED IN 478826

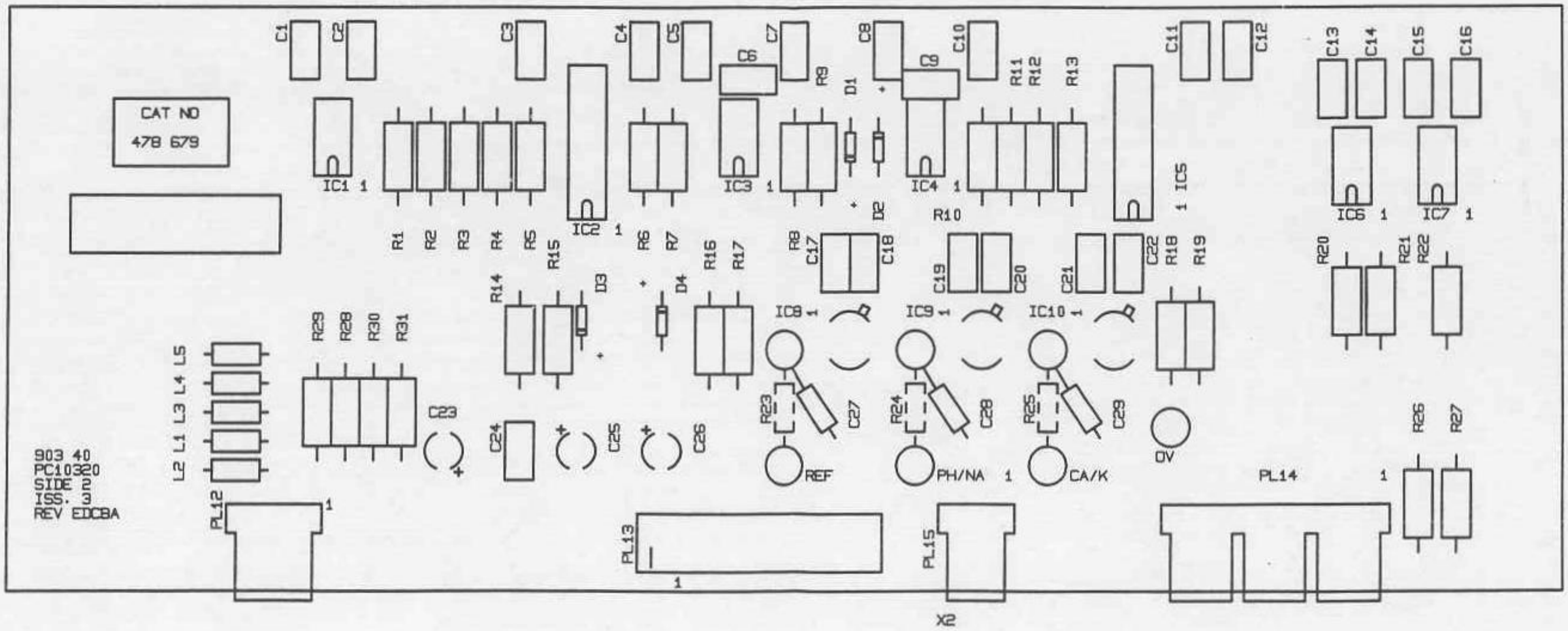

C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
R9
D1
R11
R12
R13
C11
C12
C13
C14
C15
C16
CAT NO
478 679
IC1 1
R1
R2
R3
R4
R5
IC2 1
R6
R7
IC3 1
R8
D2
IC4 1
R10
1 IC5
IC6 1
IC7 1
R15
R14
D3
D4
R16
R17
C17
C18
C19
C20
C21
C22
R18
R19
R20
R21
R22
IC8 1
IC9 1
IC10 1
R29
R28
R30
R31
L5
L4
L3
L1
L2
C23
C24
C25
C26
R23
C27
R24
C28
R25
C29
REF
PH/NA 1
CA/K
0V
R26
R27
PL14
1
903 40
PC10320
SIDE 2
ISS. 3
REV EDCBA
PL12
1
PL13
1
PL15
X2

Figure 3a - Amplifier PCB
903 40 001J

updated Pgs.

SPARES

AMPLIFIER BOARD - 90340001J

Packed spare 478 679

Cct.Ref	Cat.No.	Description
Resistors		
R1,R2,R4,R5 R16-R19	-	100 Kohm 1% 1/2W
R3	-	4.75 Kohm 1% 1/2W
R6,R9	-	6.49 Kohm 1% 1/2W
R7,R13	-	42.2 Kohm 1% 1/2W
R8	-	3.6 Kohm 2% 1/2W
R10,R14, R28-R31	-	10 Kohm 2% 1/2W
R11	-	3 Kohm 2% 1/2W
R12	-	75 Kohm 1% 1/2W
R15	-	43 Kohm 2% 1/2W
R20	-	28.7 Kohm 1% 1/2W
R21-R22	-	6.8 Mohm 5% 1/2W
R23-R25	-	100 Kohm 5% 1/4W
R26-R27	-	150 Ohm 2% 1/2W

Note : All resistors are metal film unless otherwise stated

Cct.Ref	Cat.No.	Description
Capacitors		
C1-C22,C24	-	Ceramic 100 nF, 63VW, -20/+80%
C23,C25,C26	-	Tantalum Bead, 33mF 16VW ±20%
C27-C29	-	Polystyrene (High Insulation) 160VW ±2.5%
Diodes		
D1-D4	900149207M	IN4148
Integrated Circuits		
IC1,3,4,6,7	900149710X	CA3140E
IC2	900149783L	CD4051BE
IC5	900149750N	CD4053BC
IC8	900149779A	ICL7611DCTV
IC9,10	900149731K	AD545KH
Links		
L1-L5	-	Wire Link
Plugs		
PL12	900142873M	5 way rt angle plug
PL13	990340020M	20 way ribbon cable assembly
PL14	900142875P	12 way rt angle plug
PL15	900142874N	4 way rt angle plug

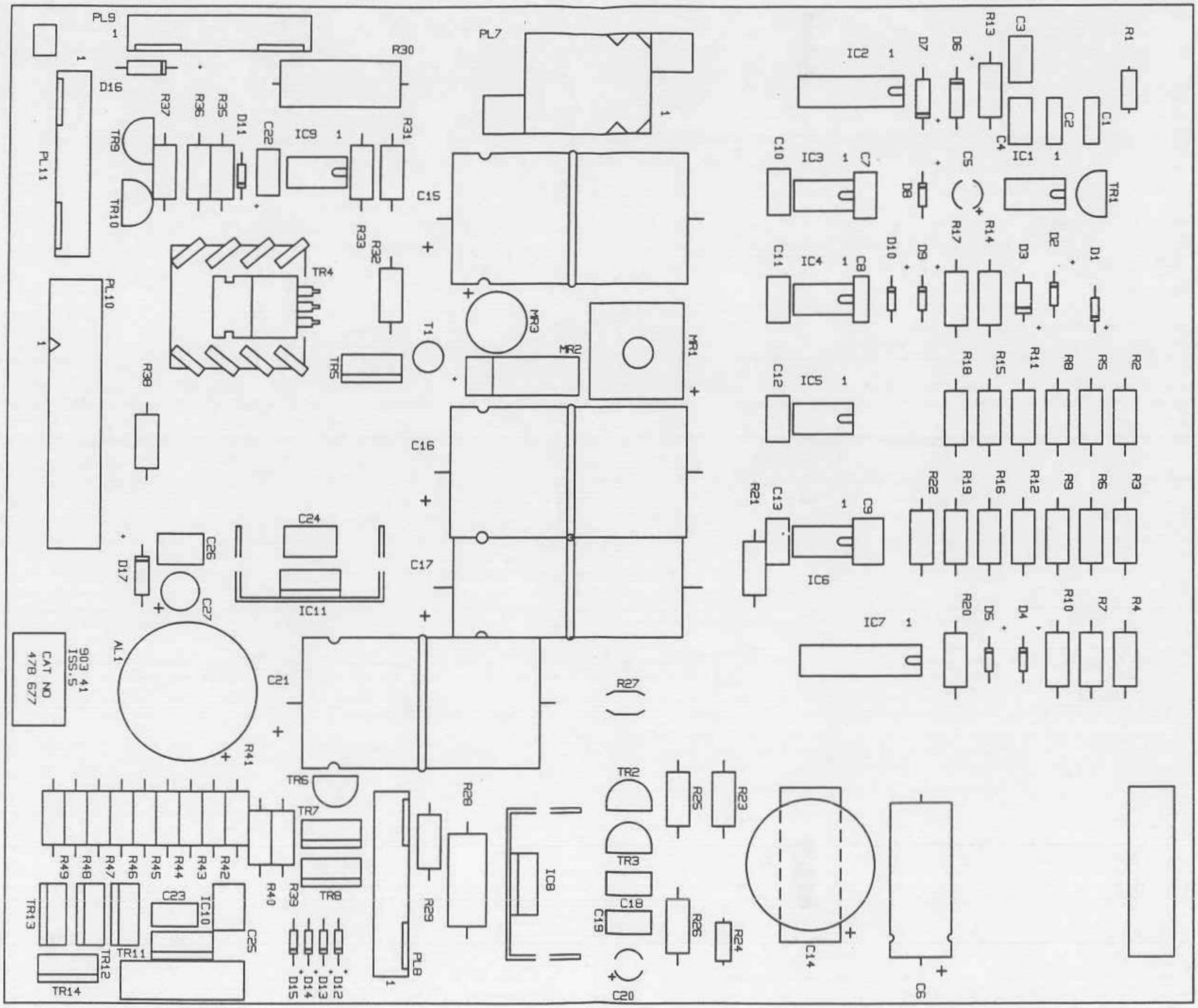

PL9
1
PL7
R30
D16
R37
R36
R35
D11
C22
IC9
R31
TR9
TR10
PL11
R33
R32
TR4
C15
PL10
1
T1
MR3
MR2
MR1
TR5
R38
C16
C24
C26
D17
C27
C17
IC11
AL1
903 41
ISS.5
CAT NO
478 677
C21
R41
TR6
TR7
R28
R27
TR2
R25
R23
TR3
C18
C19
C20
R26
R24
C14
C6
IC8
PL8
R29
R39
R40
TR8
D12
D13
D14
D15
R42
R43
R44
R45
R46
R47
R48
R49
TR13
TR12
TR11
TR14
C23
IC10
C25
IC2
D7
D6
R13
C3
R1
C4
C2
C1
IC1
TR1
C10
IC3
C7
C5
D8
R17
R14
D3
D2
D1
C11
IC4
C8
D10
D9
C12
IC5
R18
R15
R11
R8
R5
R2
R21
C13
C9
IC6
R22
R19
R16
R12
R9
R6
R3
IC7
R20
D5
D4
R10
R7
R4

Figure 4a - Power PCB
903 41 001E

Plugs

PL7	900142747E	12 way connector
PL8, PL9, PL11	900142801F	12 way connector
PL10	900142904P	20 way connector

Heatsinks

H1	990341021K	Heatsink - 5 volt regulator
H2, H3	900149793N	Heatsink TV1505
H4	900149559P	Heatsink TV4

Diodes

D1, D2, D4, D5, D11	900149207M	IN4148
D3	900149832A	6.8v Zener
D6, D7, D16, D17	900149181F	IN4007
D8, D9, D10	900149833X	IN4153
D12-D15	900149834E	7.5v Zener

Integrated Circuits

IC1	900149155X	741
IC2	900149839L	4194
IC3	900149840A	TL7705
IC4, IC6	900149841X	3425
IC5	900149842E	ICL8211
IC7	900149797E	ULN2003
IC8	900149730J	LM317T
IC9	900149710X	CA3140E
IC10	900149843F	LM340AT5
IC11	900149725M	7812

Rectifiers

MR1	900149716L	S005
MR2	900149788X	KBL02
MR3	900149293A	W005

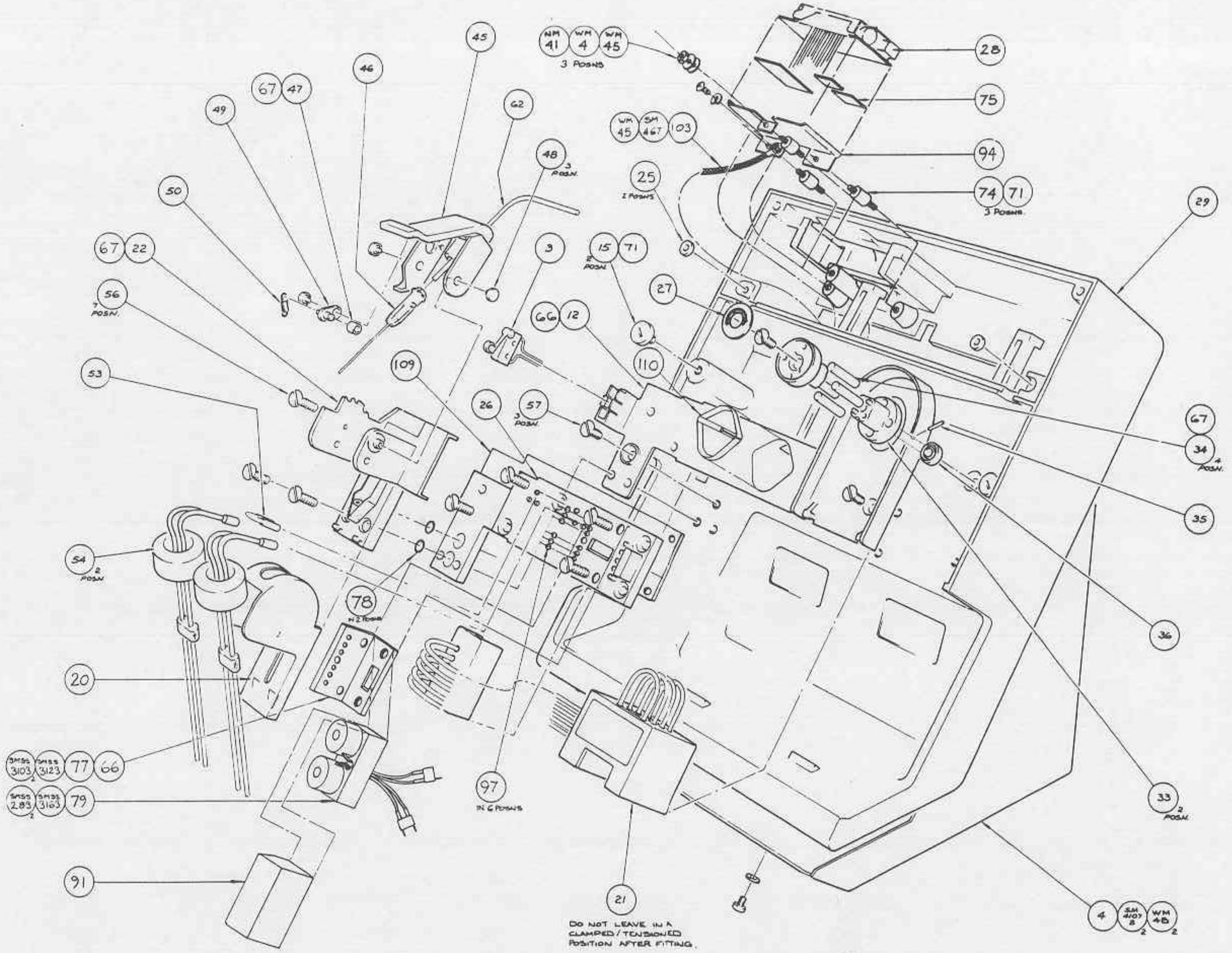
Transistors

TR1	900149835F	BC337
TR2	900149836H	BC212L
TR3	900149837J	BC182L
TR4, TR7, TR11-TR14	900149795A	BD677
TR5	900149139X	2N4920
TR6	900149838K	BC183L
TR8	900149794P	BD676
TR9	900149669J	PSA13

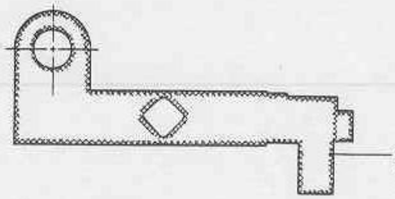
POWER BOARD 90341001E

Packed Spare 478 677

Cct.Ref.	Cat.No.	Description
Audio Alarm		
AL1	900153298K	Audible alarm
Diodes		
D1,D2,D4,D5,D11	900149207M	IN4148
D3	900149832A	6.8v Zener
D6,D7,D16,D17	900149181F	IN4007
D8,D9,D10	900149833X	IN4153
D12-D15	900149834E	7.5v Zener
Integrated Circuits		
IC1	900149155X	741
IC2	900149839L	4194
IC3	900149840A	TL7705
IC4,IC6	900149841X	3425
IC5	900149842E	ICL8211
IC7	900149797E	ULN2003
IC8	900149730J	LM317T
IC9	900149710X	CA3140E
IC10	900149843F	LM340AT5
IC11	900149725M	7812
Rectifiers		
MR1	900149716L	S005
MR2	900149788X	KBL02
MR3	900149293A	W005
Transistors		
TR1	900149835F	BC337
TR2	900149836H	BC212L
TR3	900149837J	BC182L
TR4,TR7,TR11-TR14	900149795A	BD677
TR5	900149139X	SN4920
TR6	900149838K	BC183L
TR8	900149794P	BD676
TR9	900149669J	PSA13


NM 41
WM 4
WM 45
3 POSNS
28
75
WM 45
SM 467
103
94
74
71
3 POSNS.
29
45
46
67
47
49
62
48
3 POSN.
25
2 POSNS
50
3
15
71
2 POSN.
67
22
56
7 POSN.
27
66
12
110
109
53
26
57
3 POSN.
67
34
4 POSN.
35
54
2 POSN
78
N 2 POSNS
36
20
SMSS 3103
2
SMSS 3123
77
66
SMSS 283
2
SMSS 3163
79
97
IN 6 POSNS
33
2 POSN.
91
21
4
SM 4107
2
WM 4B
2

DO NOT LEAVE IN A CLAMPED / TENSIONED POSITION AFTER FITTING.



SILICON SEALENT TO BE APPLIED TO REAR OF MANIFOLD MOUNTING PLATE AS SHOWN.

FIG 4.

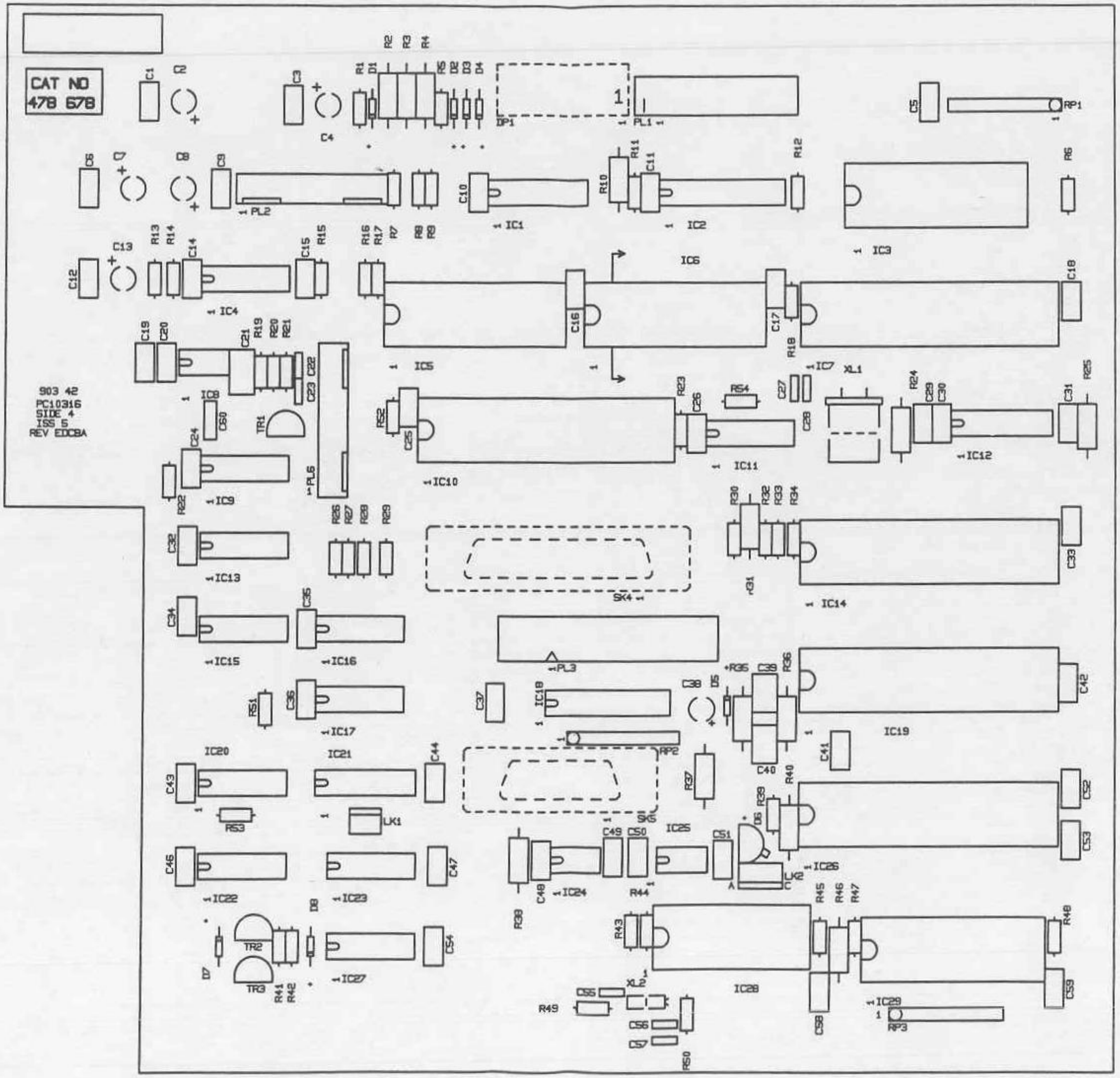

CAT NO
478 678
C1
C2
C3
C4
R1
D1
R2
R3
R4
R5
D2
D3
D4
DP1
1
PL1
C5
RP1
1
C6
C7
C8
C9
PL2
C10
IC1
R10
R11
C11
R12
IC2
R6
IC3
C12
C13
R13
R14
C14
IC4
C15
R15
R16
R17
R7
R8
R9
IC6
C16
C17
C18
R18
IC5
IC7
XL1
C19
C20
C21
R19
R20
R21
C22
C23
IC8
C60
TR1
903 42
PC10316
SIDE 4
ISS 5
REV EDCBA
R52
C25
IC10
PL6
R23
C26
R54
C27
C28
IC11
R24
C29
C30
IC12
C31
R25
C24
IC9
R22
R26
R27
R28
R29
R30
R31
R32
R33
R34
C33
IC14
C32
IC13
SK4
C34
IC15
C35
IC16
PL3
R35
C39
R36
C42
C38
D5
IC19
R51
C36
IC17
C37
IC18
RP2
C40
C41
IC20
IC21
C44
R37
R40
R39
D6
C52
C53
C43
R53
LK1
SK5
IC25
C49
C50
C51
C46
IC22
IC23
C47
R38
C48
IC24
R44
IC26
LK2
A
C
R45
R46
R47
R48
D8
R43
TR2
C54
D7
TR3
R41
R42
IC27
XL2
C55
R49
C56
C57
R50
IC28
C58
IC29
RP3
C59

Figure 5a - CPU PCB
903 42 001P

SPARES

POWER BOARD 90341001E

Packed Spare 478 677

Cct.Ref.	Cat.No.	Description
Audio Alarm		
AL1	900153298K	Audible alarm
Resistors		
R1	-	7.5 Kohm 1% 1/4W
R2, R6, R7, R9, R25, R29, R32, R40 R42, R47, R49	-	10 Kohm 2% 1/2W
R3	-	39 ohm 2% 1/2W
R4, R21	-	100 Kohm 2% 1/2W
R5, R35	-	18 Kohm 2% 1/2W
R8, R12, R38	-	4.7 Kohm 2% 1/2W
R10, R15, R16, R20	-	1 Kohm 2% 1/2W
R11	-	27 Kohm 1% 1/2W
R13	-	15 Kohm 1% 1/2W
R14	-	100 Ohm 1% 1/2W
R17, R41, R43, R46, R48	-	390 Ohm 2% 1/2W
R18	-	75 Kohm 1% 1/2W
R19	-	330 Ohm 2% 1/2W
R22	-	470 Ohm 2% 1/2W
R23	-	100 Ohm 1% 1/2W
R24	-	12 Kohm 1% 1/4W
R26	-	300 Ohm 1% 1/2W
R27	-	Varistor V22ZA1
R28	-	820 Ohm 5% 1W
R30	-	68 Ohm 5% 6W Vitreous Enamel
R31, R33	-	20 Kohm 2% 1/2W
R36	-	2 Kohm 1% 1/2W
R37	-	10 Ohm 2% 1/2W
R39, R44, R45	-	2.2 Kohm 2% 1/2W

Note : All resistors are metal film unless otherwise stated

Capacitors		
C1, C2	-	Ceramic 1nF 100VW ±20%
C3, C4, C7, C10-C13 C18, C19, C22, C23	-	Ceramic, 100nF, 63 VW +80/-20%
C5	-	Tantalum Bead 4.7mF 35VW ±20%
C6	-	Electrolytic 1000mF 10VW +50/-20%
C8	-	Metallised Polyester 0.068mF 63VW ±20%
C9	-	Metallised Polyester 330nF 63VW ±20%
C14	-	Memory back-up 0.1F 5.5VW +80/-20%
C15, C16	-	Electrolytic 4700mF 16VW +50/-10%
C17, C21	-	Electrolytic 2200mF 35VW +50/-10%
C20	-	Tantalum Bead 10mF 25VW ±20%
C24	-	Metallised Polyester 220nF 63VW ±20%
C27	-	Electrolytic 33mF 35VW +50/-10%

new pg

SPARES

CPU BOARD 903 42 001P

Packed Spare 478 678

Cct.Ref.	Cat.No.	Description
Resistors		
R1, R8	-	220 ohm 5% 1/4W
R2-R4	-	330 ohm 2% 1/2W
R5	-	150 ohm 5% 1/4W
R6, R11, R12, R15-R18, R20, R23 R26, R27, R30, R32-R34, R43-R45 R47, R48, R51-R54	-	10 Kohm 5% 1/4W
R7	-	27 ohm 5% 1/4W
R9	-	120 ohm 5% 1/4W
R10	-	510 ohm 2% 1/2W
R13	-	620 Kohm 5% 1/4W
R14	-	6.2 Kohm 5% 1/4W
R19, R21	-	47 Kohm 5% 1/4W
R22	-	2 Kohm 1% 1/4W
R24, R25, R37, R38	-	2 Kohm 1% 1/2W
R28	-	100 ohm 5% 1/4W
R29	-	2.2 Kohm 5% 1/4W
R31, R35	-	1 Mohm 2% 1/2W
R36	-	62 Kohm 2% 1/2W
R39, R41, R42	-	1 Kohm 5% 1/4W
R40, R46	-	10 Kohm 0.1% 1/2W
R49	-	5.6 Mohm 5% 1/3W
R50	-	150 Kohm 5% 1/4W

Note : All resistors are metal film unless otherwise stated

Cct.Ref.	Cat.No.	Description
Resistor Networks		
PR1-PR3	-	RESNET 10 Kohm sil pack ±2% 0.15W/Resist
Capacitors		
C1, C3, C5, C6 C9-C12, C14-C18, C20, C24-C26, C29-C37, C42-C54, C58-C59	-	Ceramic 100nF 100VW +80/-20%
C2, C4, C7, C8, C13	-	Tantalum bead 33mF 16VW ±20%
C19	-	Ceramic 10nF 100VW ±20%
C21	-	Metallised Polyester 0.47MF 63VW ±20%
C22, C23	-	Ceramic Plate 390PF 63VW ±10%
C27, C28	-	Ceramic Plate 22PF 100VW ±5%
C38	-	Tantalum Bead 4.7MF 25VW ±20%
C39	-	Metallised Polyester 47NF 63VW ±20%
C40	-	Metallised Polyester 0.068MF 63VW ±20%
C41	-	Metallised Polyester 1MF 50VW ±20%
C56, C57	-	Ceramic Plate 33PF 63VW ±10%
C60	-	Ceramic 1NF 100VW ±20%

Links

LK1	900142907E	2 position link } cut to
LK2	900142907E	3 position link } size
REF6	900142908F	Micro link 2 way (LK1,LK2)

Plugs

PL1	990341020J	20 way ribbon cable assembly
PL2,PL6	900142801F	12 way connector
PL3	900142904P	20 way connector

Sockets

SK4	900142419M	25 way connector 'D' type
SK5	900142420X	15 way connector 'D' type
REF3	900142812X	28 pin Dil Skt (IC3,IC6)

Crystals

XL1	900153314X	6.144 MHz
XL2	900153315E	32.768 KHz

Diodes

D1	900149834E	7.5v Zener
D2,D3	900149262H	2.7v Zener
D4	900149846K	8.2v Zener
D5,D7,D8	900149207M	IN4148
D6	900149796X	ICL8069

Displays

DP1	900149851F	10 element LED

Integrated Circuits

IC1	900149858M	74HCT366
IC2,IC18	900149828H	74HCT373
IC3	See Note	
IC4	900149762E	MC1488
IC5	900149744A	8251A
IC6	900149802J	2K X 8 RAM
IC7	900149733M	8085AC
IC8	900149331X	NE555N
IC9	900149790K	MC1489
IC10	900149799H	1601
IC11	900149852H	74LS05
IC12	900149800F	DAC0800LCN
IC13,IC15	900149823P	74HCT74
IC14,IC19	900149734N	P8155
IC16,IC27	900149830N	74HCT04
IC17	900149829J	74HCT393
IC20	900149824A	74HCT00
IC21	900149827F	74HCT138
IC22	900149826E	74HCT32
IC23	900149825X	74HCT08
IC24,IC25	900149820L	CA3140AE
IC26	900149736A	ICL7109CPL
IC28	900149785N	HD146818
IC29	900149850E	8259A

Transistors

TRI	9001496695	PSA13
TR2, TR3	9001498375	BC182L

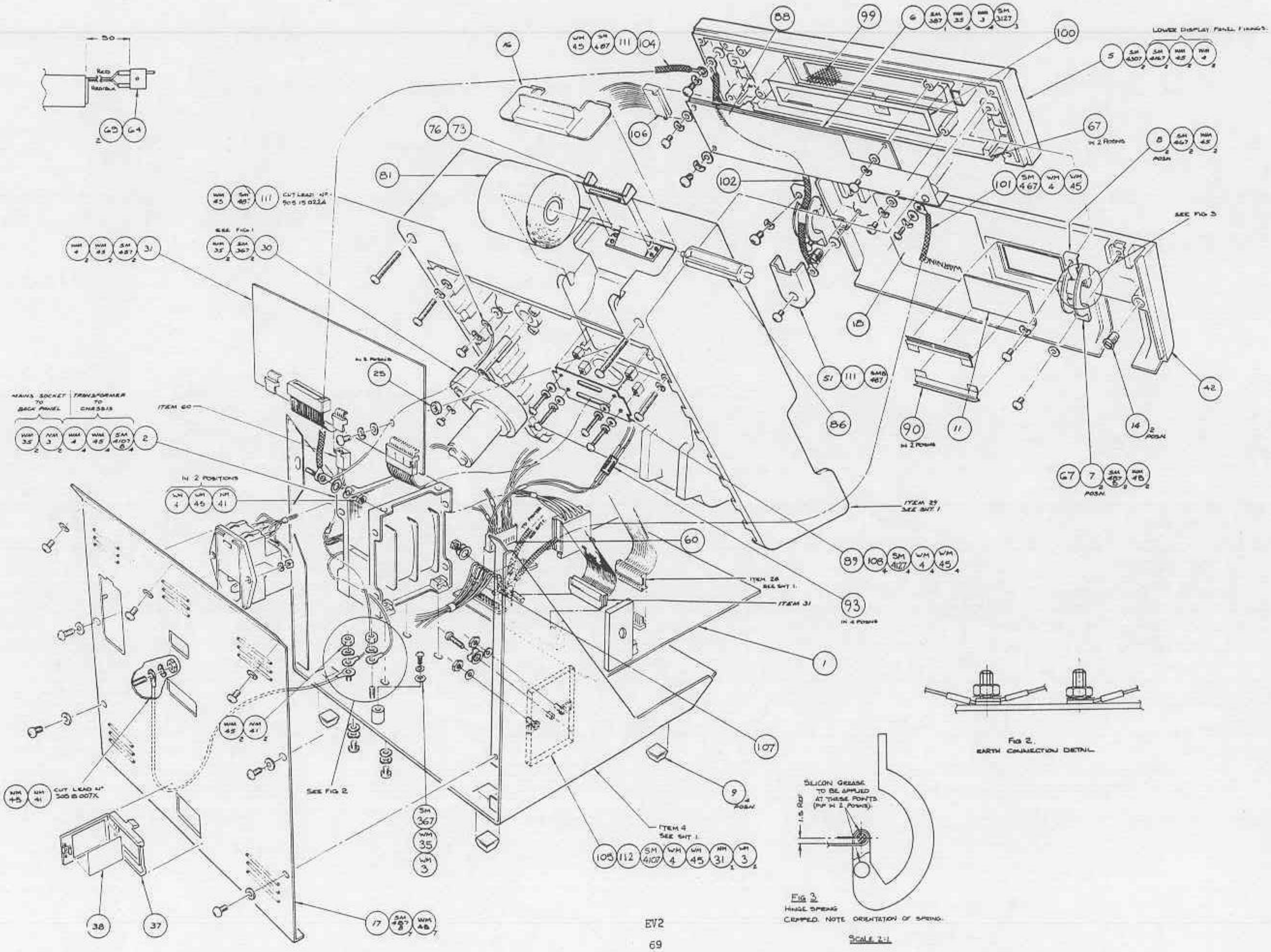
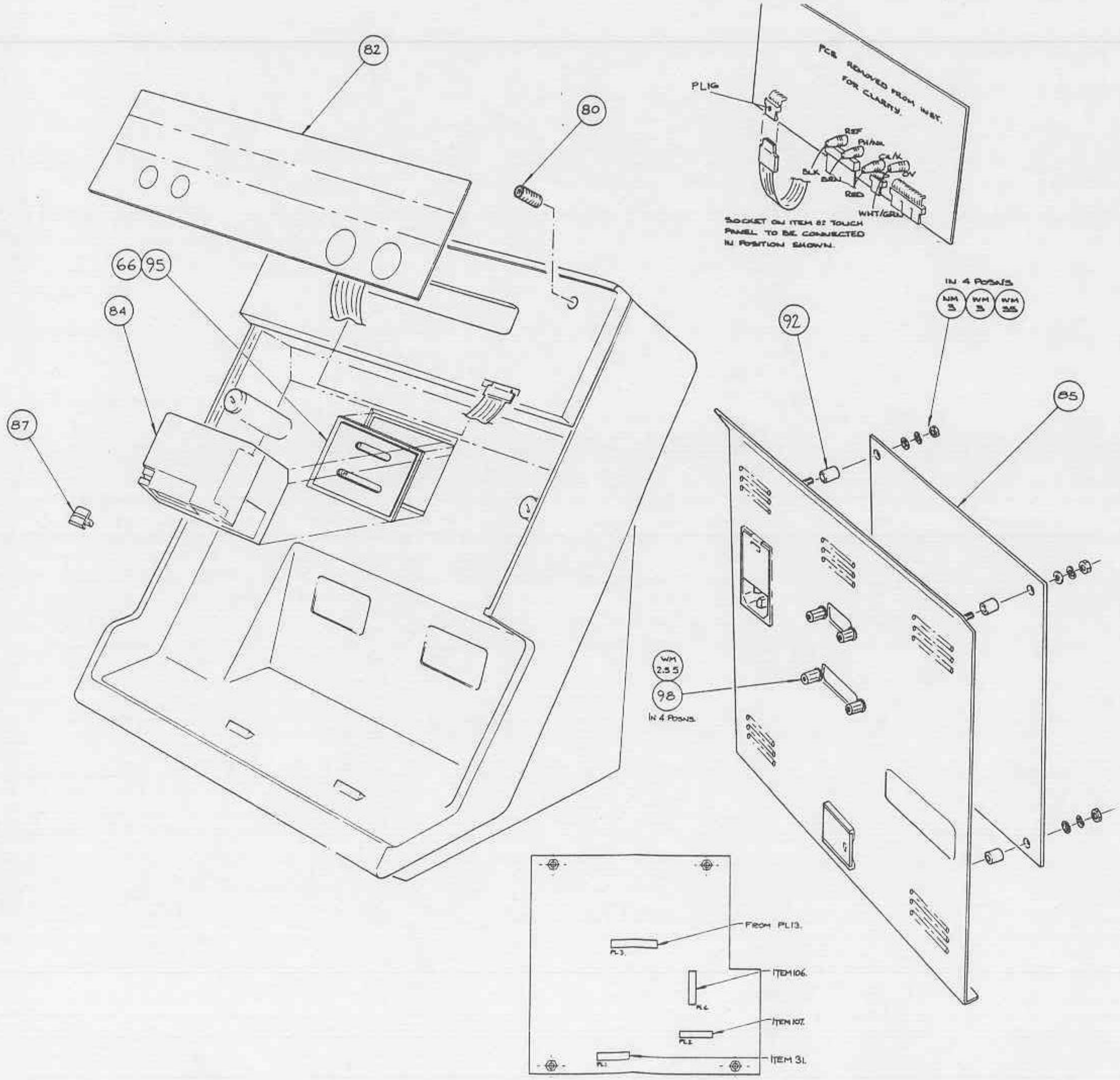

50
RED
RED/BLK
65 64
46
WM 45 SM 467 111 104
88
99
6 SM 367 WM 35 WM 3 SM 3127
100
LOWER DISPLAY PANEL FIXINGS.
5 SM 4307 SM 4167 WM 45 WM 4
76 73
106
67 IN 2 POSNS
8 SM 467 WM 45 POSN
81
102
101 SM 467 WM 4 WM 45
WM 45 SM 467 111 CUT LEAD Nº 505 15 022A
SEE FIG 3
WM 4 WM 45 SM 467 31
SEE FIG 1
WM 35 SM 367 30
18
51 111 SMB 467
42
IN 2 POSNS
25
86
90 IN 2 POSNS
11
14 POSN
MAINS SOCKET TO BACK PANEL
TRANSFORMER TO CHASSIS
ITEM 60
WM 35 WM 3 WM 4 WM 45 SM 4107 8 2
67 7 SM 467 8 WM 48 POSN
IN 2 POSITIONS
WM 4 WM 45 WM 41
ITEM 29 SEE SHT 1
60
89 108 SM 4127 WM 4 WM 45
ITEM 28 SEE SHT 1.
ITEM 31
93 IN 4 POSNS
1
WM 45 WM 41
SEE FIG 2
107
WM 45 WM 41 CUT LEAD Nº 505 15 007X
SM 367 WM 35 WM 3
9 POSN
ITEM 4 SEE SHT 1.
105 112 SM 4107 WM 4 WM 45 WM 31 WM 3
38
37
17 SM 467 8 WM 48
SILICON GREASE TO BE APPLIED AT THESE POINTS (PIP IN 2 POSNS).
1.8 RAD

Fig 2.
EARTH CONNECTION DETAIL

Fig 3
HINGE SPRING
CRIMPED. NOTE ORIENTATION OF SPRING.

SCALE 2:1

EV2


82
80
PLIG
PCB REMOVED FROM INST. FOR CLARITY.
REF
PH/ANA
CR/K
0V
BLK
BRN
RED
WHT/GRN
SOCKET ON ITEM 82 TOUCH PANEL TO BE CONNECTED IN POSITION SHOWN.
66
95
84
87
IN 4 POSNS
NM 3
WM 3
WM 3S
92
85
WM 2.5.5
98
IN 4 POSNS.
PL3.
PL4
PL2
PL1
FROM PL13.
ITEM 106.
ITEM 107.
ITEM 31.

VIEW ON CPU PCB ASSY (ITEM 85).
SCALE 1:2

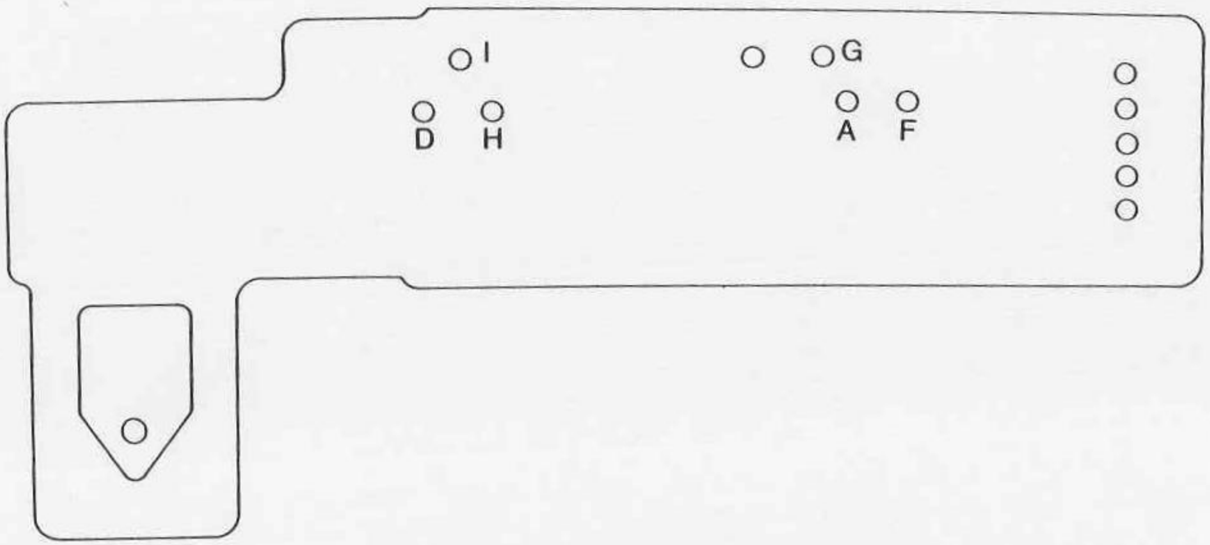


Figure 6 - Manifold showing tubing ports

ITEM	DESCRIPTION	SPARES NO. OR PART NO.	OTHER ITEMS INCLUDED	COMMENT
46	PROBE MOULDING	478634	62	
47	CAM ROLLER	90410017M		
48	RETAINING PIN	SEE ITEM 45		
49	INDEX ARM	90410019P		
50	RETURN SPRING	SEE ITEM 45		
51	WIRE COVER	90405018A		
52	NO ITEM 52			
53	LINK TUBE	478653	54	
54	TUBE ASSEMBLY	SEE ITEM 53		
55	NO ITEM 55			
56	NYLON SCREWS			INC.IN 478830
57	NYLON SCREWS			INC.IN 478830
58	NO ITEM 58			
59	NO ITEM 59			
60	MAIN CABLEFORM	478833		
61	NO ITEM 61			
62	ANALYSIS TUBE	SEE ITEM 46		
63	NO ITEM 63			
64	2-WAY CONNECTOR	SEE ITEM 30		
65	NO ITEM 65			
66	MARINE SEALANT	478831		
67	SILICON GREASE	478949		
68	NO ITEM 68			
69	INSULATION SLEEVING	SEE ITEM 30		
70	NO ITEM 70			
71	LOCTITE	00173240N		
72	NO ITEM 72			
73	PAPER TEARER	SEE ITEM 29		
74	ANTIVIBRATION MOUNT	00108748N		
75	GASKET	SEE ITEM 28		
76	PERMABOND ADHESIVE	00173299K		
77	NR SOLENOID I/F	478842	79,97,93	
78	'O' RING	SEE ITEM 22,26		
79	NR SOLENOID ASSEMBLY	SEE ITEM 77		
80	SPRING COMPRESSION	SEE ITEM 82		
81	PRINTER ROLL	478638		
82	TOUCH PANEL	90416034E	80	
83	NO ITEM 83			
84	ELECTRODE BLOCK ASSEMBLY	478828	89,95,108	
85	CPU PCB ASSEMBLY	478678		
86	PAPER ROLL DOWEL	478624		
87	TUBE LOCATOR	90511023E		
88	DISPLAY SCREEN	61405016M		
89	GASKET PLATE	SEE ITEM 84		
90	WINDOW CLIP	SEE ITEM 11		
91	SOLENOID COVER	478775		
92	NYLON SPACER	00101137F		
93	TRANSIT STRAP LABEL	SEE ITEMS 3,30 77		

614 MAIN ASSEMBLY PARTS LIST/SPARES CROSS REFERENCE

ITEM	DESCRIPTION	SPARES NO. OR PART NO.	OTHER ITEMS INCLUDED	COMMENT
1	PSU PCB ASSEMBLY	478677		
2	TRANSFORMER ASSEMBLY	90416032A		
3	MICROSWITCH	478623	93	
4	CHASSIS F & C	61405006K		
5	DISPLAY COVER F & C	90416033X	82	
6	DISPLAY MODULE	478656		
7	HINGE ARM	90407004P		
8	SPRING	90407005A		
9	RUBBER FOOT	00130010K		
10	NO ITEM 10			
11	WINDOW	90416031P	14,18,42,90	
12	MANIFOLD MOUNTING PLATE	478657		
13	NO ITEM 13			
14	MAGNETIC CATCH	SEE ITEM 11		
15	COUNTER PLATE	SEE ITEM 29		
16	PRINTER COVER	478694		
17	BACK PANEL F & C	61405004M		
18	WARNING LABEL	00178978F		
19	NO ITEM 19			
20	WEIR COVER	478633		
21	PUMP TUBE CASSETTE	478639		
22	COVER, PROBE MOUNTING	478829	78	
23	NO ITEM 23			
24	NO ITEM 24			
25	SCREW, RETAINING	SEE ITEM 31		INC.IN 478830
26	MANIFOLD PERSPEX	478841	78,109	
27	ROTOR LABLE	478664	33,34,35	
28	PRINTER ASSEMBLY	478661	75	
29	BULKHEAD MOULDING F & C	90416038K	15,73	
30	MOTOR/GEARBOX	478666	36,64,69,93	
31	AMPLIFIER PCB ASSEMBLY	478679		
32	NO ITEM 32			
33	ROTOR CAGE	SEE ITEM 27		
34	PUMP ROLLER	SEE ITEM 27		
35	DOWEL PIN	SEE ITEM 27		
36	SHAFT SEAL	SEE ITEM 30		
37	INSPECTION COVER	90405010F		
38	STATUS INDICATOR DOOR LABEL	00187122L		
39	NO ITEM 39			
40	NO ITEM 40			
41	NO ITEM 41			
42	ELECTRODE COVER F & C	SEE ITEM 11		
43	NO ITEM 43			
44	NO ITEM 44			
45	PROBE LEVER	478654	48,50	

ITEM	DESCRIPTION	SPARES NO. OR PART NO.	OTHER ITEMS INCLUDED	COMMENT
94	PRINTER TRAY	61405022K		
95	BLOCK GASKET	SEE ITEM 84		
96	NO ITEM 96			
97	'O' RING	SEE ITEM 77		
98	SPACER, STUD	00101138H		
99	DISPLAY MESH	61405018P		
100	MESH GASKET	61405019A		
101	SCREENED CABLE	61405025N		
102	SCREENED CABLE	61405026P		
103	SCREENED CABLE	61405027A		
104	SCREENED CABLE	61405028X		
105	HEATSINK	61405017N		
106	DISPLAY CABLEFORM	478832		
107	POWER CABLEFORM	478834		
108	NO ITEM 108			
109	MANIFOLD GASKET	SEE ITEM 26		
110	MOUNTING PLATE PLUG	478825		
111	GROUNDING WASHER	61405031L		
112	HEATSINK COMPOUND	00149208N		
113	BULKHEAD LABEL	00178921M		
114	BULKHEAD LABEL	00178920L		

614 INTERCONNECTION TABLE

SCHEDULE 1 - TOUCH PANEL TO AMPLIFIER BOARD

Touch Panel Switch	Amplifier Board (PL12)
Switch Return	Pin 1
Sam No. Reset	Pin 2
Paper Feed	Pin 3
'Yes' key	Pin 4
'No' key	Pin 5

SCHEDULE 2 - AMPLIFIER BOARD TO CPU BOARD

Amplifier Board (PL13)	Function	CPU Board (PL3)
1	Analogue 0V	1
2	Analogue Signal O/P	2
3	Signal 0V	3
4	Offset Signal I/P	4
5	Analogue 0V	5
6	1.23V Reference	6
7	Analogue 0V	7
8	Analogue +6V	8
9	Analogue -6V	9
10	Digital +5V	10
11	Digital 0V	11
12	'Yes' Key	12
13	'No' Key	13
14	Sam No Reset	14
15	Paper Feed	15
16	Mux Select D0	16
17	Mux Select D1	17
18	Mux Select D2	18
19	Channel Select	19
20	Ca/K Gain Select	20

SCHEDULE 3 - AMPLIFIER BOARD TO ELECTRODE BLOCK

Amplifier Board (PL14)	Function	Electrode Block
1	Sample Detector 2 I/P	Sample Detector 2
2	0V	Sample Detector 2
3	Sample Detector 2 LED O/P	Sample Detector 2
4	Analogue 0V	Sample Detector 2
5	Thermistor	Thermistor
6	0V	Sample Detector 1
7	Sample Detector 1 I/P	Sample Detector 1
8	Sample Detector 1 LED O/P	Sample Detector 1
9	Thermistor	Thermistor
10	Analogue 0V	Sample Detector 1
11		
12		

REF	(X3)	Ref Electrode I/P	Black wire
pH/Na	(X1)	pH/Na Electrode I/P	Brown or white wire
Ca/K	(X4)	Ca/K Electrode I/P	Red wire
Ground	(X2)	Screen	White/green wire

SCHEDULE 4 - AMPLIFIER BOARD TO POWER BOARD

Amplifier Board (PL15)	Function	Power Board (PL9)
1	Heater Control	1
2	Heater (-12V)	11

SECTION 5 - POWER BOARD TO TRANSFORMER ASSEMBLY

Power Board (PL7)	Function	Transformer Assy (Wire Colour)
1	10V AC (+5V)	Violet
2	20V AC (+12V)	Black
3	20V AC (+12V)	Black
4	10V AC (+5V)	Violet
5	N/C	
6	N/C	
7	Ground	Green/yellow
8	N/C	
9	N/C	
10	10V AC (-12V)	Grey
11	10V AC (-12V)	Grey
12	N/C	

SCHEDULE 6 - POWER BOARD TO PRINTER

Power Board (PL8)	Function	Printer
1	Resdet	1
2	Digital 0V	2
3	Printer 0V	3
4	Motor Drive	4
5	Printer +5V	5
6	Solenoid Drive	6
7	Solenoid Drive	7
8	Solenoid Drive	8
9	Solenoid Drive	9
10	Digital 0V	10
11	Tacho Sense	11
12	N/C	

SCHEDULE 7 - POWER BOARD TO uSWITCH/SOLENOIDS/MOTOR/HWARE

Power Board (PL9)	Function	Destination/Wire Colour
1	See Schedule 4	
2	Upper Solenoid	Black
3	uSwitch	White/Green
4	Upper Solenoid	White
5	Lower Solenoid	White/Black
6	Lower Solenoid	Black/White
7	N/C	
8	Motor Drive (+ve)	Black
9	Motor Drive (-ve)	Red
10	N/C	
11	See Schedule 4	
12	uSwitch	White/Green

SCHEDULE 8 - POWER BOARD TO CPU BOARD (SIGNALS)

Power Board (PL10)	Function	CPU Board (PL1)
1	Power Reset	1
2	Mains Power Status	2
3	Printer Power Status	3
4	Motor On/Off	4
5	Motor Speed	5
6	Upper Solenoid Control	6
7	Lower Solenoid Control	7
8	Ram/Rtc Deselect	8
9	Heater Control	9
10	Inreg Indicator	10
11	Alarm Control	11
12	Printer Solenoid Control	12
13	Printer Solenoid Control	13
14	Printer Solenoid Control	14
15	Printer Solenoid Control	15
16	Printer Sense	16
17	Resdet	17
18	Printer Motor Control	18
19	uSwitch	19
20	Motor on Indicator	20

SCHEDULE 9 - POWER BOARD TO CPU BOARD (POWER)

Power Board (PL11)	Function	CPU Board (PLR)
1	+5V Digital	1
2	Digital 0V	2
3	Analogue +6V	3
4	Analogue -6V	4
5	Analogue 0V	5
6	+ 12V	6
7	- 12V	7

8	VBack	8
9	+5V Digital	9
10	Digital 0V	10
11	Digital 0V	11
12	Digital 0V	12

SCHEDULE 10 - CPU BOARD TO DISPLAY

CPU Board (PL6)	Function	Display
1	Digital 0V	1
2	+5V Digital	2
3	Data Bit 0	3
4	Data Bit 1	4
5	Data Bit 2	5
6	Data Bit 3	6
7	Data Bit 4	7
8	Data Bit 5	8
9	Data Bit 6	9
10	Data Bit 7	10
11	Data Strobe	11
12	Busy	12

SCHEDULE 11 - DATA OUTPUT SOCKET

CPU Board SK4	Function
2	RS232 TX Data O/P
3	RS232 RX Data O/P
4	RTS
6	DSR
7	Signal Ground
8	20mA TX -ve
9	20mA TX +ve
10	20mA RX -ve
11	20mA RX +ve
14	+12V
18	-12V
24	Security Key Pull-up
25	+5V Digital

SCHEDULE 12 - PERIPHERALS CONTROL SOCKET

CPU Board SK5	Function
5	Probe Up Status
6	Probe Down Status
7	Last Sample Flag Status
9	+5V Digital
12	Sampler Motor Drive
13	0V Digital
14	On/Off Line Status
15	Stat Key Status

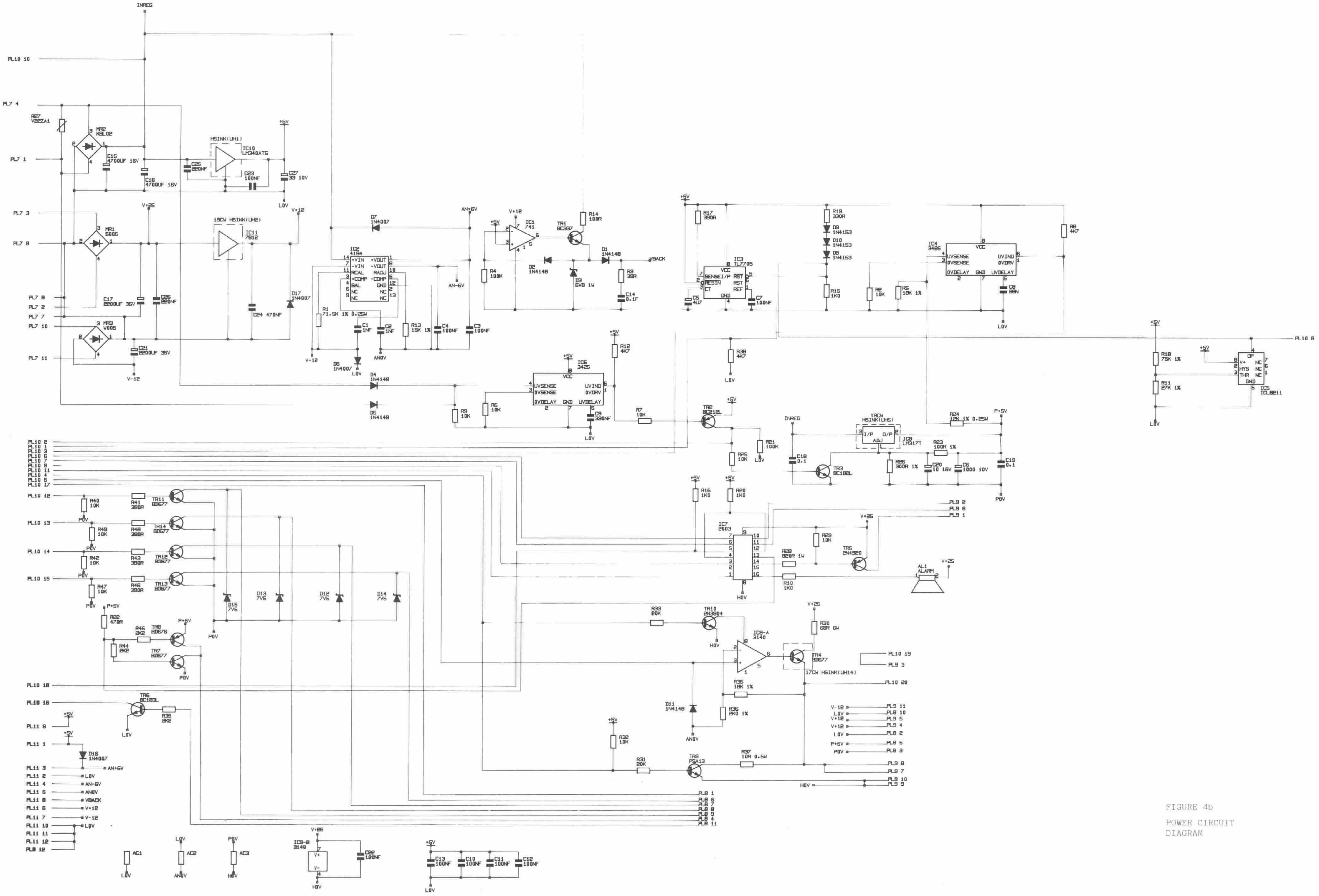
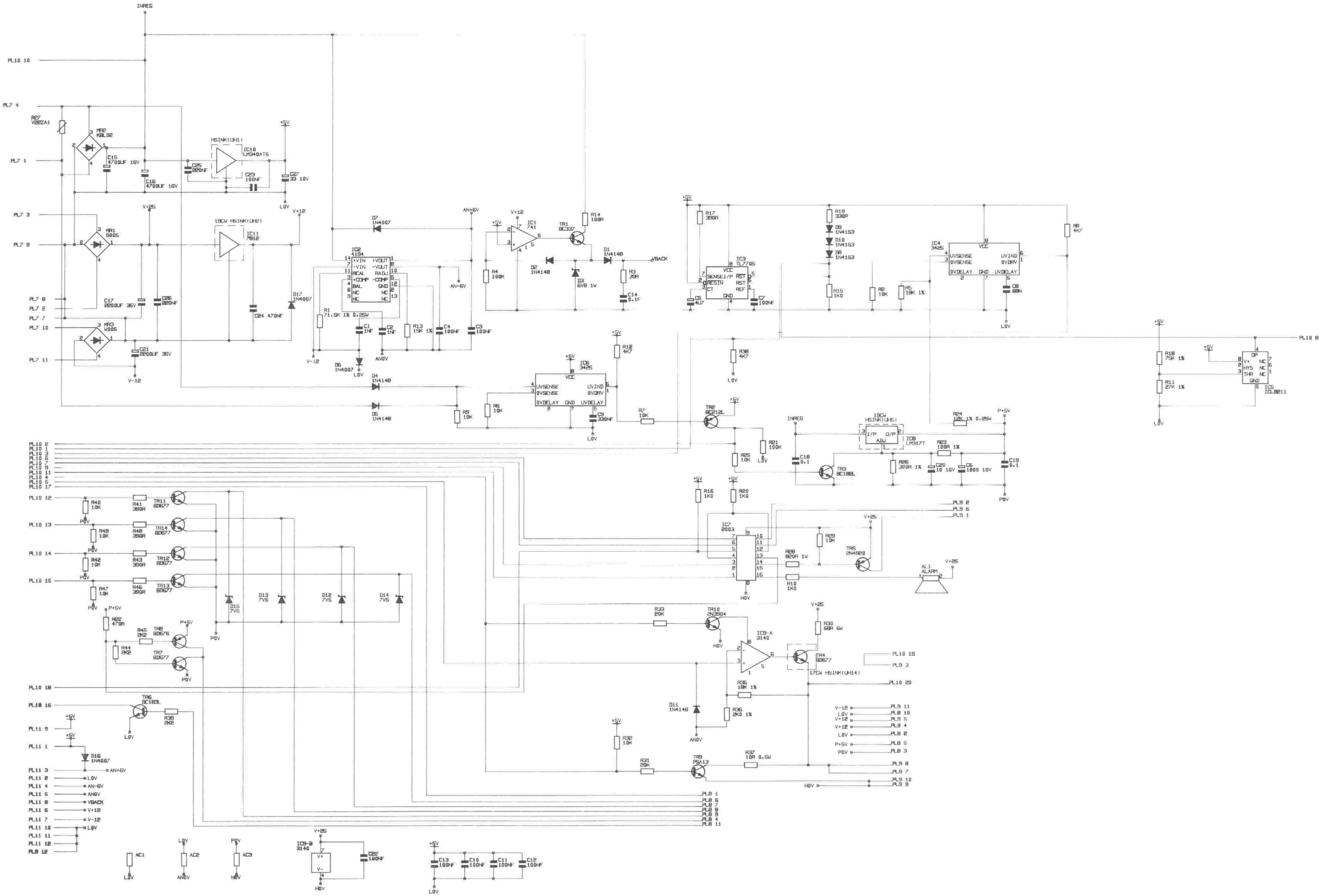

INREG
PL10 10
PL7 4
R27 VB27ZA1
MR2 KBL02
PL7 1
C15 4700UF 16V
C16 4700UF 16V
HSINK(UH1)
IC10 LM340AT5
C25 220NF
C23 100NF
C27 33 10V
+5V
L0V
PL7 3
V+25
V+12
PL7 9
MR1 S005
19CW HSINK(UH2)
IC11 7812
PL7 8
PL7 2
PL7 7
PL7 10
PL7 11
C17 2200UF 36V
C26 220NF
C24 470NF
D17 1N4007
MR3 W005
C21 2200UF 36V
V-12
D7 1N4007
AN+6V
IC2 4194
+VIN
-VIN
RCAL
+COMP
BAL
NC
+VOUT
-VOUT
RADJ
-COMP
GND
AN-6V
R1 71.5K 1% 0.25W
C1 1NF
C2 1NF
R13 15K 1%
C4 100NF
C3 100NF
D6 1N4007
ANOV
D4 1N4148
D5 1N4148
IC1 741
TR1 BC337
R14 100R
D2 1N4148
D3 6V8 1W
D1 1N4148
VBACK
R4 100K
R3 39R
C14 0.1F
IC6 3425
VCC
UVSENSE
OVSENSE
OVDELAY
GND
UVDELAY
UVIND
OVDRV
R12 4K7
R6 10K
R9 10K
C9 330NF
R7 10K
TR2 BC212L
R21 100K
R25 10K
R17 390R
IC3 TL7705
SENSE
I/P
RESIN
CT
RST
REF
C5 4U7
C7 100NF
R19 330R
D9 1N4153
D10 1N4153
D8 1N4153
R15 1K0
R2 10K
R5 18K 1%
IC4 3425
C8 68N
R8 4K7
R38 4K7
PL10 8
R18 75K 1%
R11 27K 1%
IC5 ICL8211
V+
HYS
THR
OP
NC
INREG
19CW HSINK(UH5)
I/P
O/P
ADJ
IC8 LM317T
R24 12K 1% 0.25W
P+5V
R23 100R 1%
C18 0.1
TR3 BC182L
R26 300R 1%
C20 10 16V
C6 1000 10V
C19 0.1
P0V
PL10 2
PL10 1
PL10 3
PL10 6
PL10 7
PL10 9
PL10 11
PL10 4
PL10 5
PL10 17
PL10 12
R40 10K
R41 390R
TR11 BD677
PL10 13
R49 10K
R48 390R
TR14 BD677
PL10 14
R42 10K
R43 390R
TR12 BD677
PL10 15
R47 10K
R46 390R
TR13 BD677
D15 7V5
D13 7V5
D12 7V5
D14 7V5
R16 1K0
R20 1K0
IC7 2003
H0V
PL9 2
PL9 6
PL9 1
R29 10K
TR5 2N4920
R28 820R 1W
R10 1K0
AL1 ALARM
R22 470R
R45 8K2
TR8 BD676
R44 8K2
TR7 BD677
R33 20K
TR10 2N3904
IC9-A 3140
R30 68R 6W
TR4 BD677
17CW HSINK(UH14)
PL10 19
PL9 3
PL10 20
R35 18K 1%
R36 8K0 1%
D11 1N4148
PL10 18
PL10 16
TR6 BC183L
R39 8K2
PL11 9
PL11 1
D16 1N4007
PL11 3
PL11 2
PL11 4
PL11 5
PL11 8
PL11 6
PL11 7
PL11 10
PL11 11
PL11 12
PL8 12
VBACK
R32 10K
R31 20K
TR9 PSA13
R37 10R 0.5W
PL9 11
PL9 10
PL9 5
PL9 4
PL8 2
PL8 5
PL8 3
PL9 8
PL9 7
PL9 10
PL9 9
PL8 1
PL8 6
PL8 7
PL8 8
PL8 9
PL8 4
PL8 11
AC1
AC2
AC3
IC9-B 3140
C22 100NF
C13 100NF
C10 100NF
C11 100NF
C12 100NF

FIGURE 4b

POWER CIRCUIT DIAGRAM


INREG
PL10 10
PL7 4
R27 V22ZA1
MR2 KBL02
PL7 1
C15 4700UF 16V
C16 4700UF 16V
HSINK(UH1)
IC10 LM340AT5
C25 220NF
C23 100NF
+5V
C27 33 10V
L0V
PL7 3
V+25
19CW HSINK(UH2)
IC11 7812
V+12
PL7 9
MR1 S005
PL7 8
PL7 2
PL7 7
PL7 10
PL7 11
C17 2200UF 35V
C26 220NF
C24 470NF
D17 1N4007
MR3 W005
C21 2200UF 35V
V-12
D7 1N4007
AN+6V
IC2 4194
+VIN
-VIN
RCAL
+COMP
BAL
NC
+VOUT
-VOUT
RADJ
-COMP
GND
AN-6V
R1 71.5K 1% 0.25W
C1 1NF
C2 1NF
R13 15K 1%
C4 100NF
C3 100NF
D6 1N4007
AN0V
IC1 741
TR1 BC337
R14 100R
R4 100K
D2 1N4148
D3 6V8 1W
D1 1N4148
VBACK
R3 39R
C14 0.1F
D4 1N4148
D5 1N4148
R9 10K
R6 10K
IC6 3425
VCC
UVSENSE
OVSENSE
OVDELAY
UVIND
OVDRV
UVDELAY
C9 330NF
R12 4K7
R7 10K
TR2 BC212L
R21 100K
R25 10K
R17 390R
IC3 TL7705
SENSEI/P
RESIN
CT
RST
REF
C5 4U7
C7 100NF
R19 330R
D9 1N4153
D10 1N4153
D8 1N4153
R15 1K0
R2 10K
R5 18K 1%
IC4 3425
C8 68N
R8 4K7
R38 4K7
PL10 8
R18 75K 1%
R11 27K 1%
IC5 ICL8211
DP
V+
HYS
THR
P+5V
R24 12K 1% 0.25W
19CW HSINK(UH5)
I/P
O/P
ADJ
IC8 LM317T
R23 100R 1%
C18 0.1
TR3 BC182L
R26 300R 1%
C20 10 16V
C6 1000 10V
C19 0.1
P0V
PL10 2
PL10 1
PL10 3
PL10 6
PL10 7
PL10 9
PL10 11
PL10 4
PL10 5
PL10 17
PL10 12
R40 10K
R41 390R
TR11 BD677
PL10 13
R49 10K
R48 390R
TR14 BD677
PL10 14
R42 10K
R43 390R
TR12 BD677
PL10 15
R47 10K
R46 390R
TR13 BD677
D15 7V5
D13 7V5
D12 7V5
D14 7V5
R22 470R
R45 2K2
TR8 BD676
R44 2K2
TR7 BD677
PL10 18
PL10 16
TR6 BC183L
R39 2K2
PL11 9
PL11 1
D16 1N4007
PL11 3
PL11 2
PL11 4
PL11 5
PL11 8
PL11 6
PL11 7
PL11 10
PL11 11
PL11 12
PL8 12
AC1
AC2
AC3
IC9-B 3140
C22 100NF
H0V
C13 100NF
C10 100NF
C11 100NF
C12 100NF
R16 1K0
R20 1K0
IC7 2003
PL9 2
PL9 6
PL9 1
R29 10K
R28 820R 1W
TR5 2N4920
R10 1K0
AL1 ALARM
R33 20K
TR10 2N3904
IC9-A 3140
R30 68R 6W
TR4 BD677
17CW HSINK(UH14)
PL10 19
PL9 3
PL10 20
R35 18K 1%
R36 2K0 1%
D11 1N4148
R32 10K
R31 20K
TR9 PSA13
R37 10R 0.5W
PL9 11
PL8 10
PL9 5
PL9 4
PL8 2
PL8 5
PL8 3
PL9 8
PL9 7
PL9 10
PL9 9
PL8 1
PL8 6
PL8 7
PL8 8
PL8 9
PL8 4
PL8 11

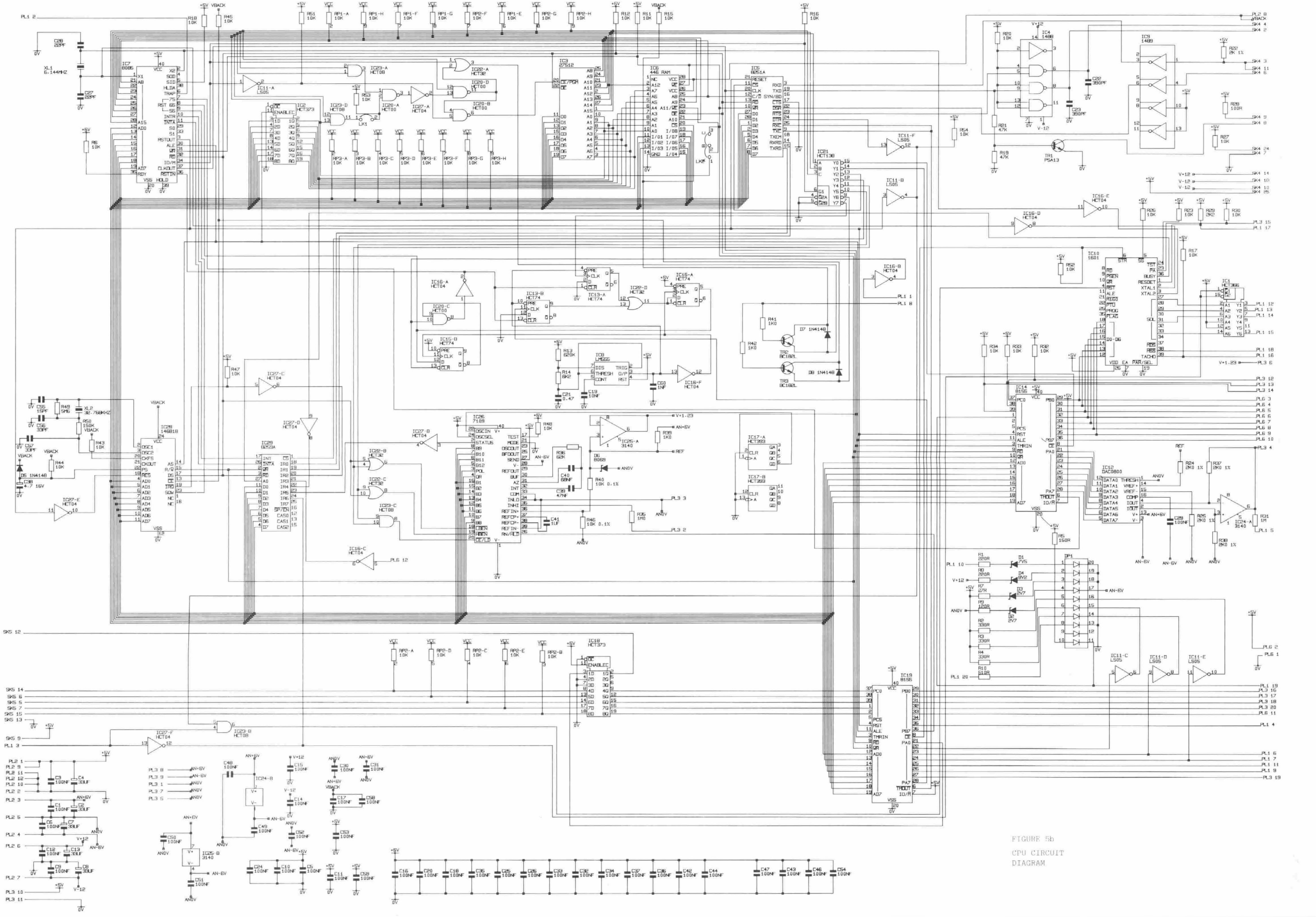
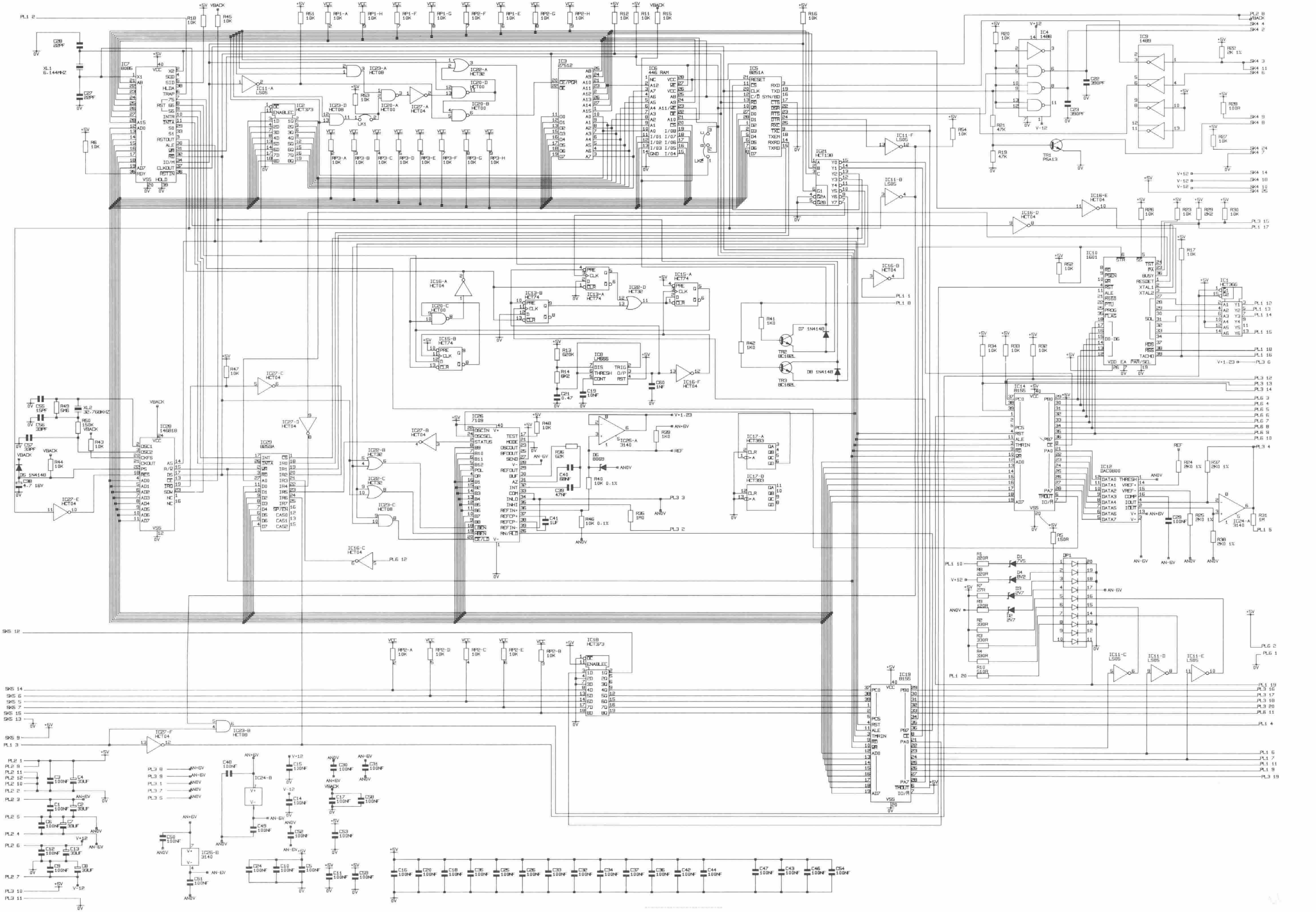

IC7 8085
XL1 6.144MHZ
IC3 27512
IC6 446 RAM
IC5 8251A
IC2 HCT373
IC21 HCT138
IC4 1488
IC9 1489
TR1 PSA13
IC10 1601
IC1 HCT366
IC8 LM555
IC13-A HCT74
IC13-B HCT74
IC15-A HCT74
IC15-B HCT74
IC22-D HCT32
TR2 BC182L
TR3 BC182L
D7 1N4148
D8 1N4148
IC14 8155
IC12 DAC0800
IC24-A 3140
IC26 7109
IC25-A 3140
IC28 146818
XL2 32.768KHZ
IC29 8259A
IC17-A HCT393
IC17-B HCT393
IC18 HCT373
IC19 8155
DP1
IC11-C LS05
IC11-D LS05
IC11-E LS05
IC23-B HCT08
IC27-F HCT04
IC24-B
IC25-B 3140

FIGURE 5b

CPU CIRCUIT
DIAGRAM



IC7 8085
XL1 6.144MHZ
C28 22PF
C27 22PF
IC11-A LS05
IC23-A HCT08
IC22-A HCT32
IC20-D HCT00
IC20-A HCT00
IC27-A HCT04
IC20-B HCT00
IC23-D HCT08
LK1
IC2 HCT373
ENABLEC
IC3 27512
IC5 446 RAM
LK2
IC6 8251A
IC21 HCT138
IC11-F LS05
IC11-B LS05
IC4 1488
IC9 1489
C22 390PF
C23 390PF
TR1 PSA13
SK4 2
SK4 3
SK4 4
SK4 6
SK4 7
SK4 8
SK4 9
SK4 10
SK4 11
SK4 14
SK4 24
SK4 25
IC16-E HCT04
IC16-D HCT04
IC16-B HCT04
IC16-A HCT04
IC13-A HCT74
IC13-B HCT74
IC20-D HCT32
IC15-A HCT74
IC15-B HCT74
IC20-C HCT00
IC8 LM555
IC16-F HCT04
TR2 BC182L
TR3 BC182L
D7 1N4148
D8 1N4148
IC10 1601
IC1 HCT366
IC14 8155
IC12 DAC0800
IC24-A 3140
IC25-A 3140
IC26 7109
IC17-A HCT393
IC17-B HCT393
D6 8069
IC27-C HCT04
IC27-D HCT04
IC27-B HCT04
IC27-E HCT04
IC22-B HCT32
IC22-C HCT32
IC23-C HCT08
IC16-C HCT04
IC28 146818
XL2 32.768KHZ
IC29 8259A
DP1
D1 7V5
D4 8V2
D3 2V7
D2 2V7
IC11-C LS05
IC11-D LS05
IC11-E LS05
IC18 HCT373
IC19 8155
IC27-F HCT04
IC23-B HCT08
IC24-B
IC25-B 3140
PL1 2
PL1 3
PL2 1
PL2 2
PL2 3
PL2 4
PL2 5
PL2 6
PL2 7
PL2 8
PL2 9
PL2 10
PL2 11
PL2 12
PL3 10
PL3 11
SK5 12
SK5 14
SK5 6
SK5 5
SK5 7
SK5 15
SK5 13
SK5 8
+5V
VCC
VBACK
V+12
V-12
AN+6V
AN-6V
ANOV
0V

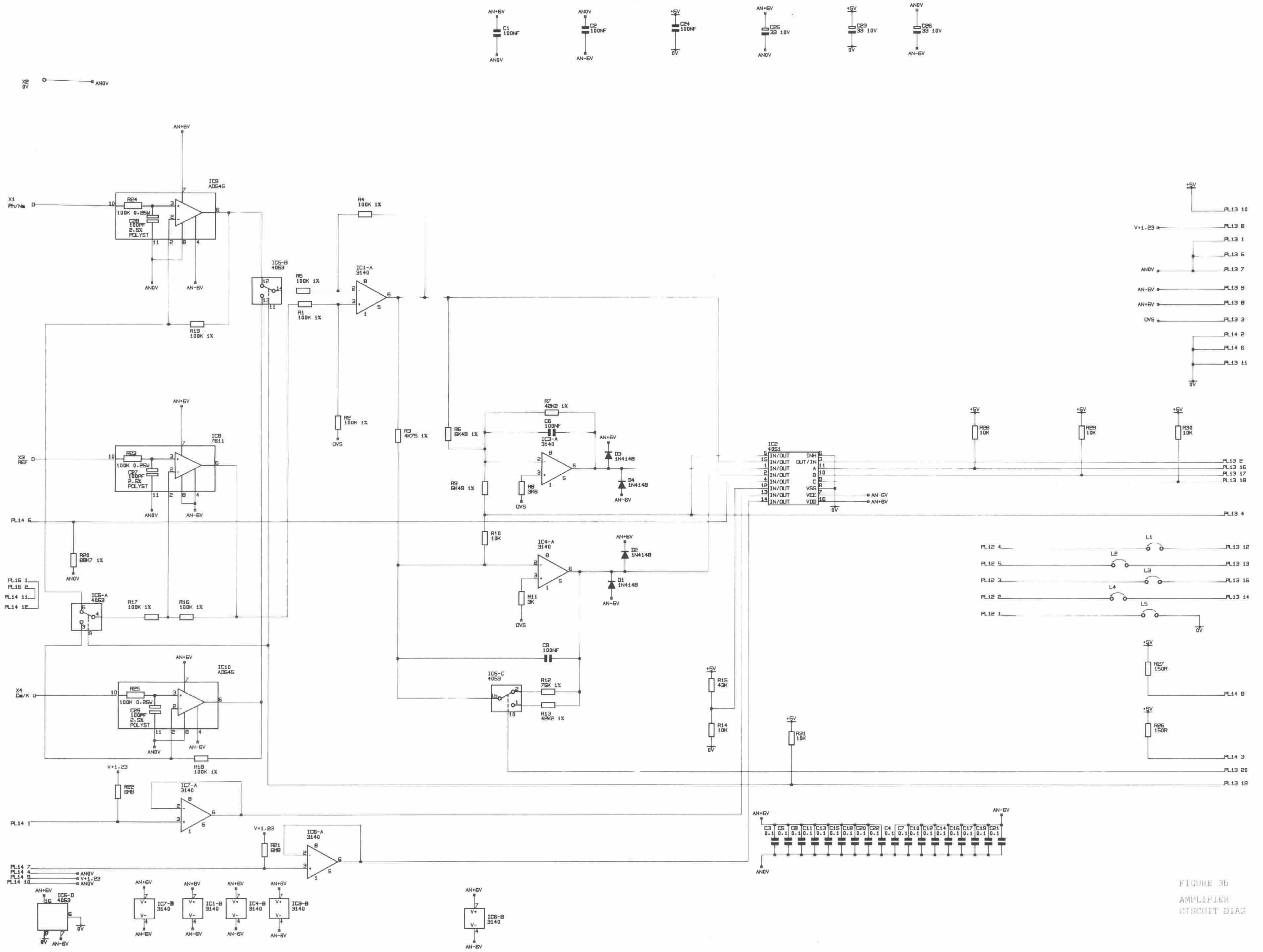

AN+6V
C1
100NF
AN0V
C2
100NF
AN-6V
+5V
C24
100NF
0V
C25
33 10V
C23
33 10V
C26
33 10V
X2
0V
X1
Ph/Na
R24
100K 0.25W
C28
100PF
2.5%
POLYST
IC9
AD645
IC5-B
4053
R5
100K 1%
R1
100K 1%
R4
100K 1%
IC1-A
3140
R19
100K 1%
R2
100K 1%
0VS
R3
4K75 1%
R6
6K49 1%
R7
40K2 1%
C6
100NF
IC3-A
3140
D3
1N4148
D4
1N4148
R8
3K6
R9
6K49 1%
X3
REF
R23
100K 0.25W
C27
100PF
2.5%
POLYST
IC8
7611
PL14 5
R20
28K7 1%
PL15 1
PL15 2
PL14 11
PL14 12
IC5-A
4053
R17
100K 1%
R16
100K 1%
R10
10K
IC4-A
3140
D2
1N4148
D1
1N4148
R11
3K
C9
100NF
IC5-C
4053
R12
75K 1%
R13
40K2 1%
X4
Ca/K
R25
100K 0.25W
C29
100PF
2.5%
POLYST
IC10
AD645
R18
100K 1%
V+1.23
R22
6M8
IC7-A
3140
PL14 1
R21
6M8
IC6-A
3140
PL14 7
PL14 4
PL14 9
PL14 10
IC5-D
4053
IC7-B
3140
IC1-B
3140
IC4-B
3140
IC3-B
3140
IC6-B
3140
V+
V-
IC2
4051
IN/OUT
OUT/IN
INH
A
B
C
VSS
VEE
VDD
R15
43K
R14
10K
R31
10K
R28
10K
R29
10K
R30
10K
PL13 10
PL13 6
PL13 1
PL13 5
PL13 7
PL13 9
PL13 8
PL13 3
PL14 2
PL14 6
PL14 11
PL13 2
PL13 16
PL13 17
PL13 18
PL13 4
PL12 4
PL12 5
PL12 3
PL12 2
PL12 1
L1
L2
L3
L4
L5
PL13 12
PL13 13
PL13 15
PL13 14
R27
150R
PL14 8
R26
150R
PL14 3
PL13 20
PL13 19
C3
C5
C8
C11
C13
C15
C18
C20
C22
C4
C7
C10
C12
C14
C16
C17
C19
C21
0.1

FIGURE 3b

AMPLIFIER
CIRCUIT DIAG

APPENDIX A CONTENTS

TABLE 1 Blood sample sequence A-2

TABLE 2 Urine sample sequence A-2

TABLE 3 Calibration sequence A-3

TABLE 4 Slope sequence A-3

TABLE 5 Deproteinize/condition sequence A-4

TABLE 6 Prime and drain sequence A-4

TABLE 7 Wet sequence A-5

TABLE 8 Flush sequence A-5

1 BLOOD SAMPLE SEQUENCE

Initiated when "Yes" is pressed in answer to "PROBE IN SAMPLE?"

	Action	Motor (volts)	Cal Solenoid	Slope Solenoid	Terminating State
1	Aspirate sample	1.78	OFF	OFF	Leading edge Triggers SD1
2	Display "RETURN PROBE"	OFF	OFF	OFF	Probe returned
3	Move sample through block	1.78	OFF	OFF	Trailing edge triggers SD1
4	Measure sample	OFF	OFF	OFF	End of measure sequence
5	Flush sequence	See Table 8			

2 URINE SAMPLE SEQUENCE (also applies to urine slope)

Initiated when "Yes" pressed in answer to "PROBE IN UR SAMPLE?"

	Action	Motor (volts)	Cal Solenoid	Slope Solenoid	Terminating State
1	Aspirate sample	1.78	OFF	OFF	Leading edge triggers SD1
2	Move sample quickly	5.52	OFF	OFF	After 8 seconds
3	Display "RETURN PROBE"	OFF	OFF	OFF	Probe returned
4	Move sample through block	1.78	OFF	OFF	Trailing edge triggers SD1
5	Measure sample	OFF	OFF	OFF	End of measure sequence
6	Flush sequence	See Table 8			

3 CALIBRATION SEQUENCE

	Action	Motor (volts)	Cal Solenoid	Slope Solenoid	Terminating State
1	Aspirate solution	8.50	OFF	ON	After 0.5 secs
2	Aspirate solution	8.50	ON	OFF	After 2.0 secs
3	Aspirate solution	8.50	OFF	OFF	After 2.0 secs
4	Pause	OFF	OFF	OFF	After 3.0 secs
5	Aspirate solution	4.00	OFF	OFF	After 4.0 secs
6	Aspirate cal solution	1.78	ON	OFF	Leading edge triggers SD1
7	Move cal through block	1.78	OFF	OFF	Trailing edge triggers SD1
8	Measure cal solution and update	OFF	OFF	OFF	End of cal measure sequence
9	Flush sequence	See Table 8			

4 SLOPE SEQUENCE

Initiated automatically during 2 point standardisation

	Action	Motor (volts)	Cal Solenoid	Slope Solenoid	Terminating State
1	Aspirate solution	8.50	OFF	ON	After 1.0 secs
2	Aspirate solution	8.50	OFF	OFF	After 2.0 secs
3	Aspirate slope	1.78	OFF	ON	Leading edge triggers SD2
4	Aspirate slope	1.78	OFF	ON	2 secs
5	Measure slope solution and update	OFF	OFF	OFF	End of slope measure sequence
6	Flush sequence	See Table 8			

5 DEPROTEINIZE/CONDITION SEQUENCE

Initiated by pressing "Yes" to "PROBE IN SOLN C?" (OR D)

	Action	Motor (volts)	Cal Solenoid	Slope Solenoid	Terminating State
1	Aspirate solution Aspirate solution	8.50 1.78	OFF OFF	OFF OFF	After 7.5 secs (DEPRO) BD2 Triggers (COND)
2	Check solution	OFF	OFF	OFF	Solution in place
3	Pause	OFF	OFF	OFF	5 minutes or pressing "No"
4	Flush sequence	See Table 8			

6 PRIME AND DRAIN SEQUENCE

Initiated by pressing "Yes" to "PRIME?" or "DRAIN?"

	Action	Motor (volts)	Cal Solenoid	Slope Solenoid	Terminating State
1	Aspirate solution	8.50	OFF	ON	After 30 secs (Prime) After 45 secs (Drain)
2	Pause	OFF	OFF	OFF	After 1 sec
3	Aspirate solution	8.50	ON	OFF	After 30 secs (Prime) After 45 secs (Drain)
4	Aspirate solution	8.50	OFF	OFF	After 2 secs

7 WET SEQUENCE

Initiated automatically (periodic 10 minute basis)

	Action	Motor (volts)	Cal Solenoid	Slope Solenoid	Terminating State
1	Run pump	6.00	OFF	OFF	After 0.5 secs
2	Aspirate solution	6.00	OFF	ON	After 0.5 secs
3	Aspirate solution	3.25	ON	OFF	After 2.0 secs
4	Aspirate solution	3.25	OFF	OFF	After 2.0 secs
5	Aspirate solution	3.25	ON	OFF	After 2.0 secs
6	Aspirate solution	3.25	OFF	OFF	After 2.0 secs
7	Pause	OFF	OFF	OFF	After 3.0 secs
8	Aspirate solution	4.00	OFF	OFF	After 4.0 secs

8 FLUSH SEQUENCE

	Action	Motor (volts)	Cal Solenoid	Slope Solenoid	Terminating State
1	Run pump	6.00	OFF	OFF	After 0.5 secs
2	Aspirate solution	6.00	OFF	ON	After 0.5 secs
3	Aspirate solution	8.50	ON	OFF	After 2.0 secs
4	Aspirate solution	8.50	OFF	OFF	After 2.0 secs
5	Aspirate solution	8.50	ON	OFF	After 2.0 secs
6	Aspirate solution	8.50	OFF	OFF	After 2.0 secs
7	Pause	OFF	OFF	OFF	After 3.0 secs
8	Aspirate solution	4.00	OFF	OFF	After 4.0 secs

new

APPENDIX B ELECTRONIC WAVEFORMS

FIGURE 1 Waveform at K8 Pin 3 B-2
FIGURE 2 Waveform at IC7 Pin 30 B-2
FIGURE 3 Waveform at IC7 Pin 37 B-2
FIGURE 4 Waveform at IC19 Pin 22 B-3
FIGURE 5 Waveform at IC8 Pin 23 B-3
FIGURE 6 Waveform at IC10 Pin 11 B-3
FIGURE 7 Waveform at IC7 Pin 7 B-4
FIGURE 8 Waveform at IC28 Pin 23 B-4
FIGURE 9 Flush cycle timing diagram B-5
FIGURE 10 Sample cycle timing diagram B-5
FIGURE 11 Calibration sequence timing diagram B-6
FIGURE 12 Slope sequence timing diagram B-6
FIGURE 13 Prime and drain sequence timing diagram B-7
FIGURE 14 Wet sequence timing diagrams B-7

IC8 pin 3

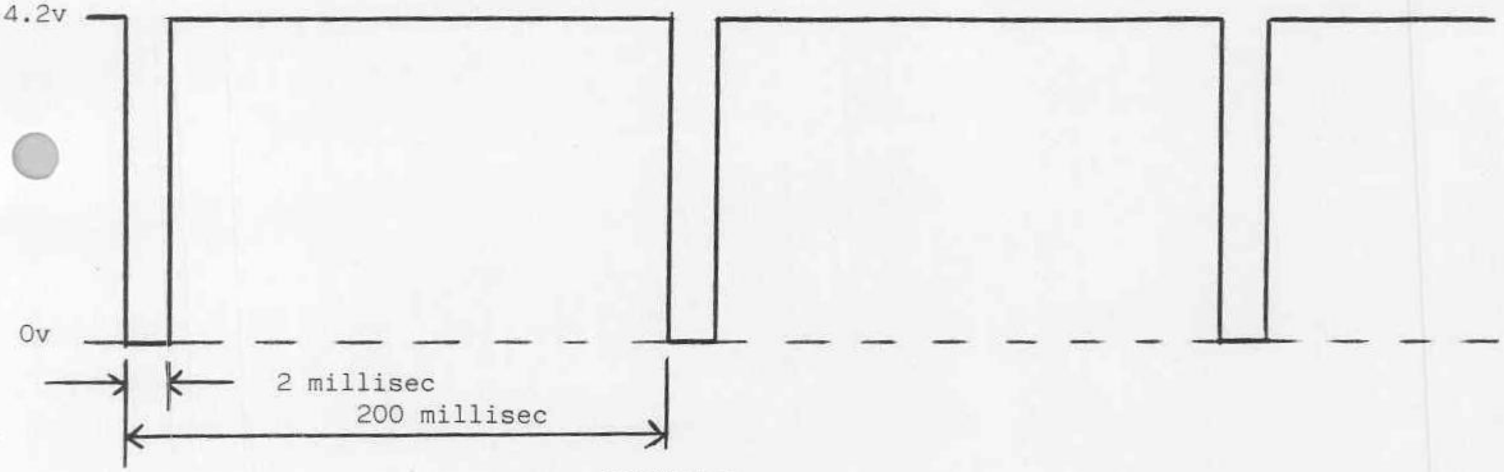


FIGURE 1

IC7 pin 30

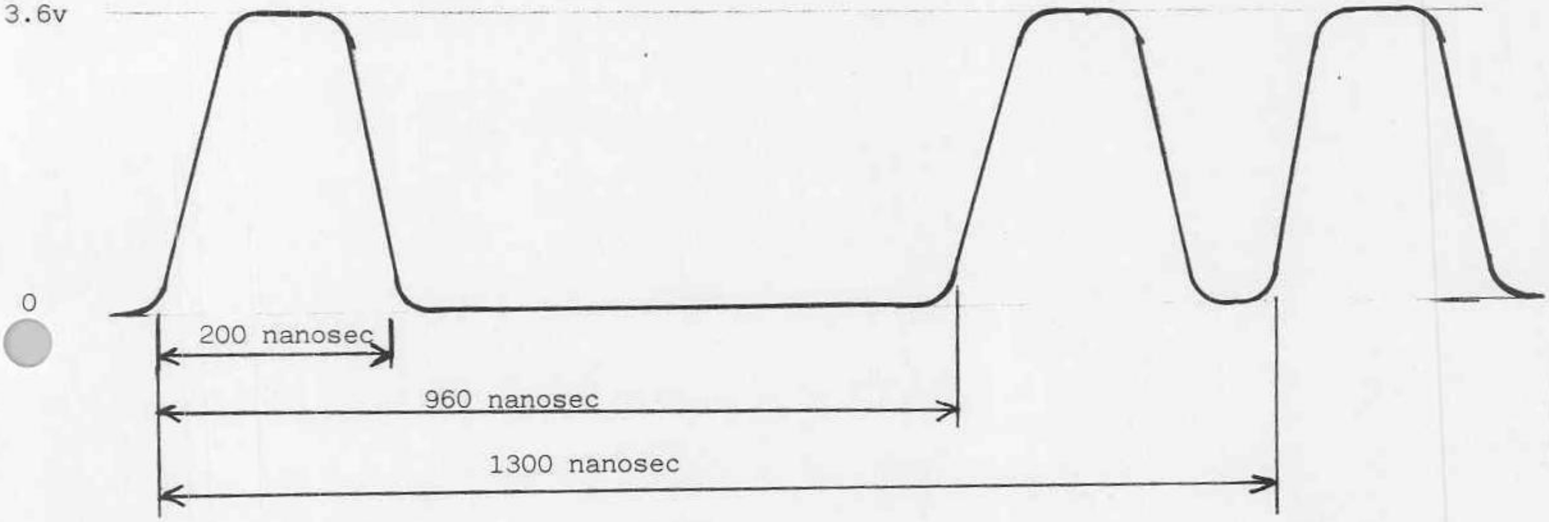


FIGURE 2

IC7 pin 37

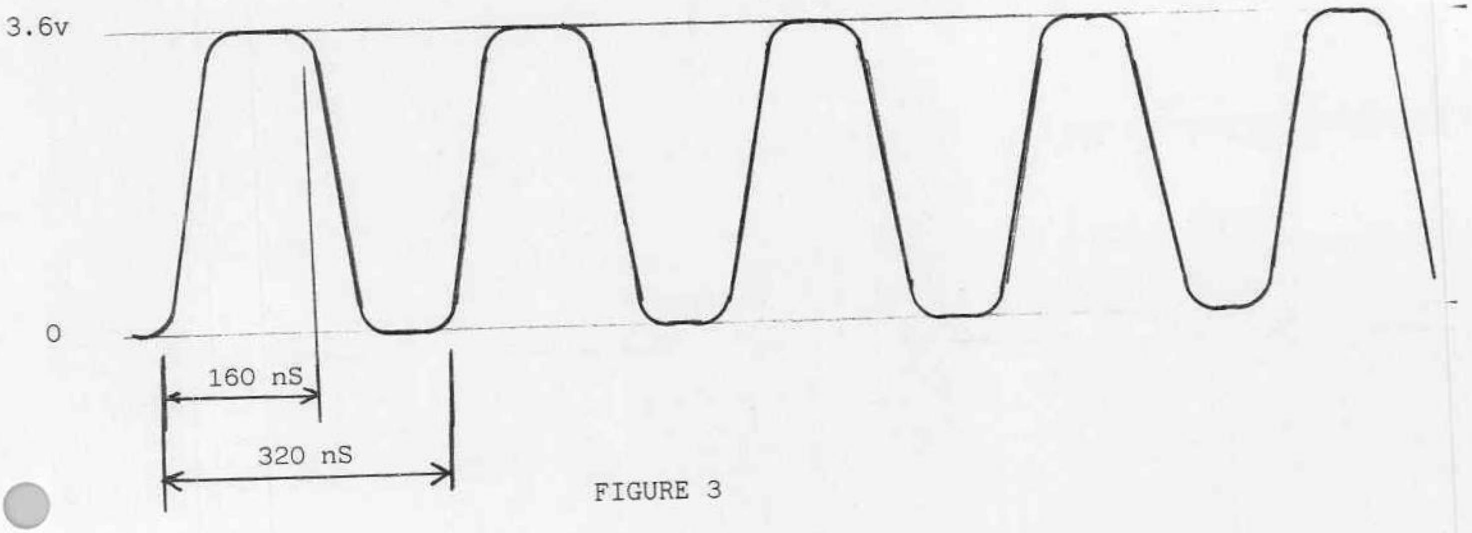


FIGURE 3

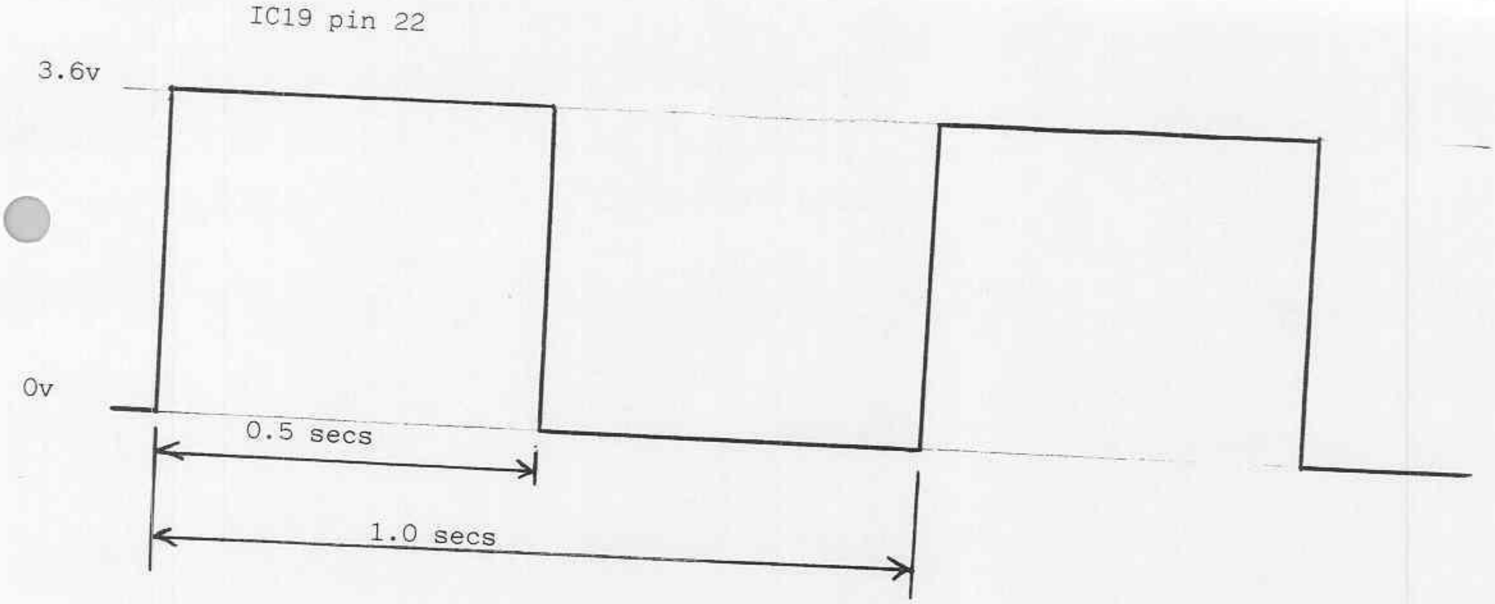

IC19 pin 22
3.6v
0v
0.5 secs
1.0 secs

FIGURE 4

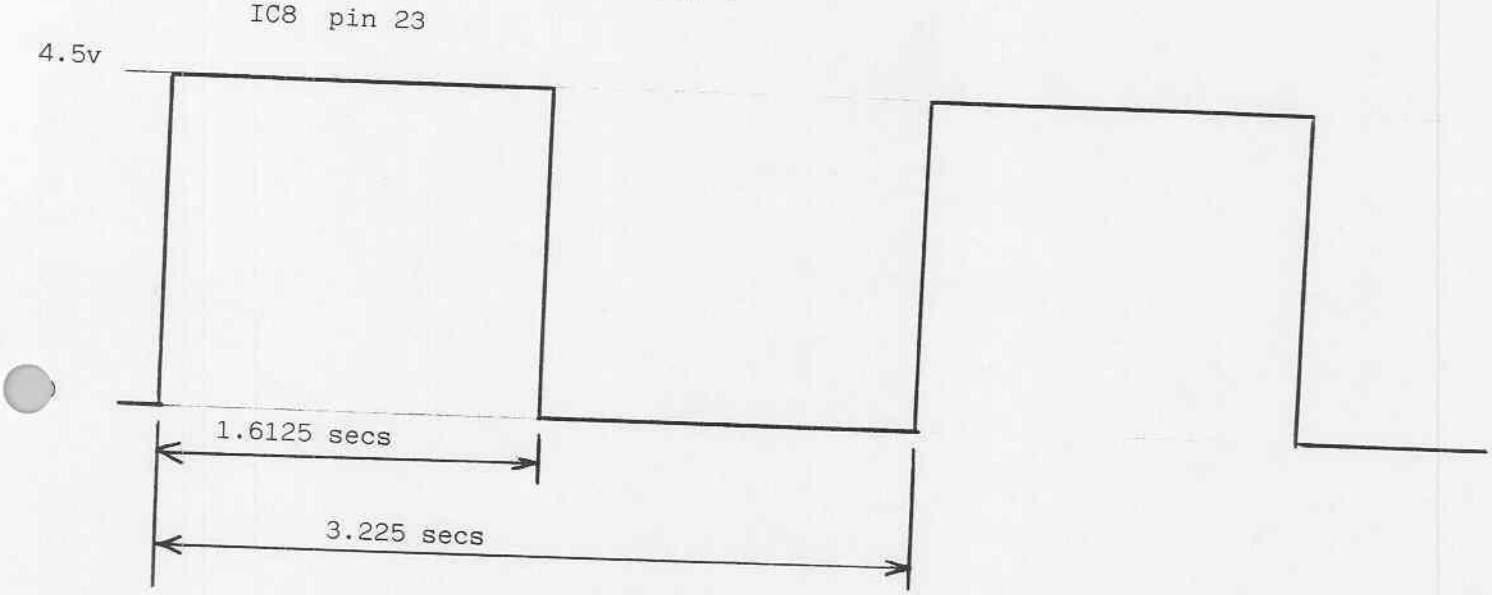

IC8 pin 23
4.5v
1.6125 secs
3.225 secs

FIGURE 5

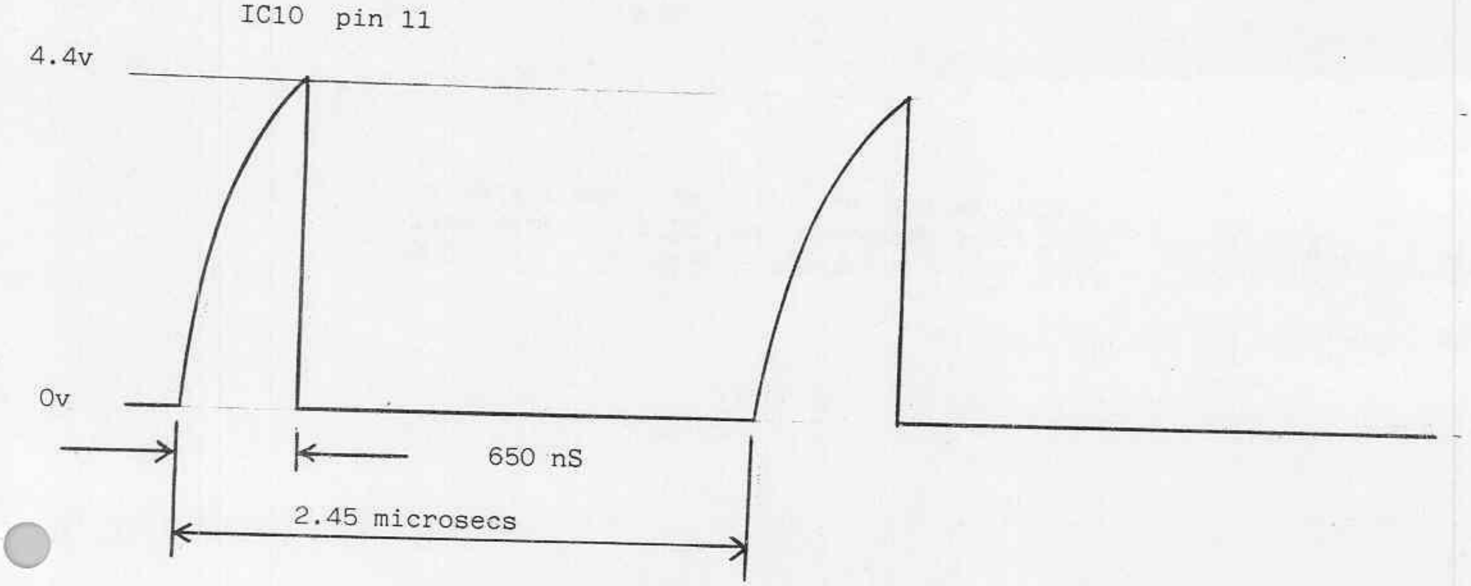

IC10 pin 11
4.4v
0v
650 nS
2.45 microsecs

FIGURE 6

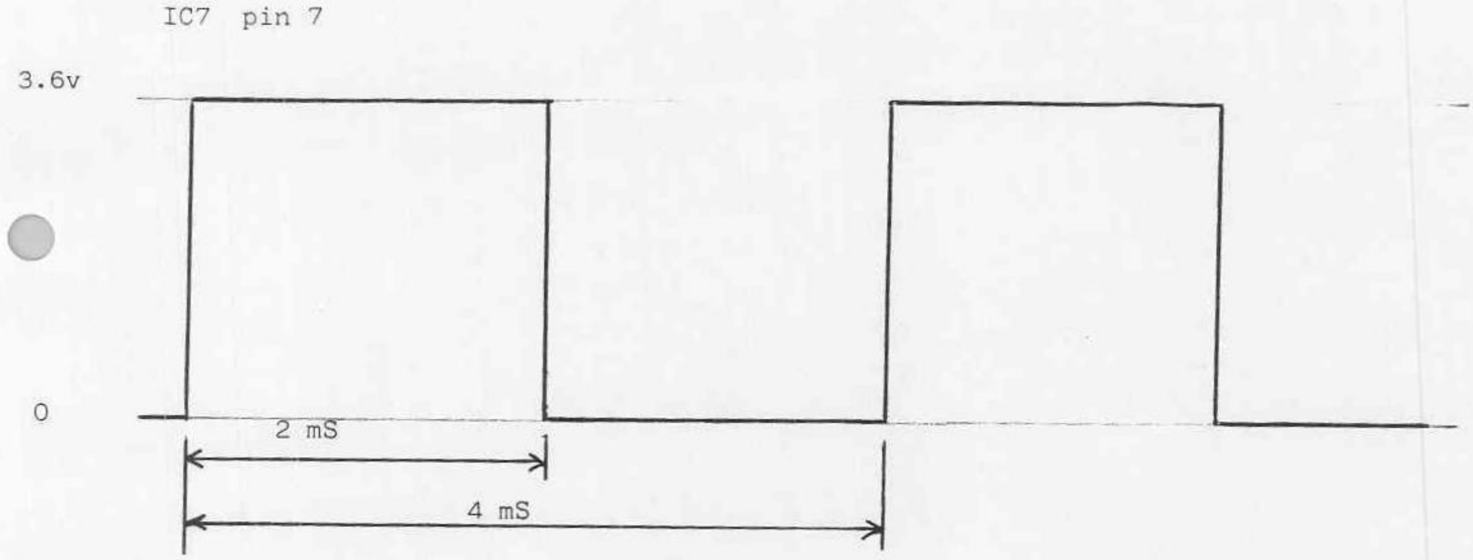

IC7 pin 7
3.6v
0
2 mS
4 mS

FIGURE 7

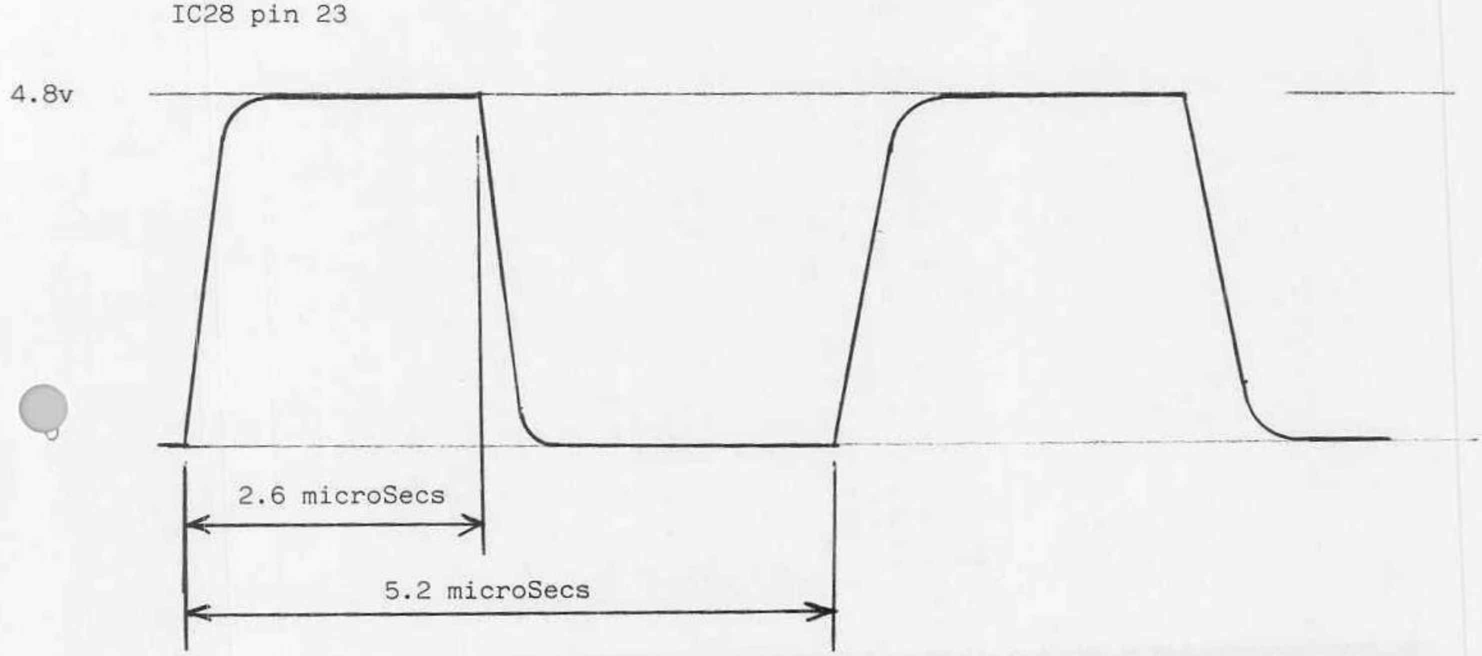

IC28 pin 23
4.8v
2.6 microSecs
5.2 microSecs

FIGURE 8

Notes All times and voltages shown are typical only
All integrated circuit pin references are with respect to Figure 5B
- CPU Board in the service manual

FIGURE 9 FLUSH CYCLE

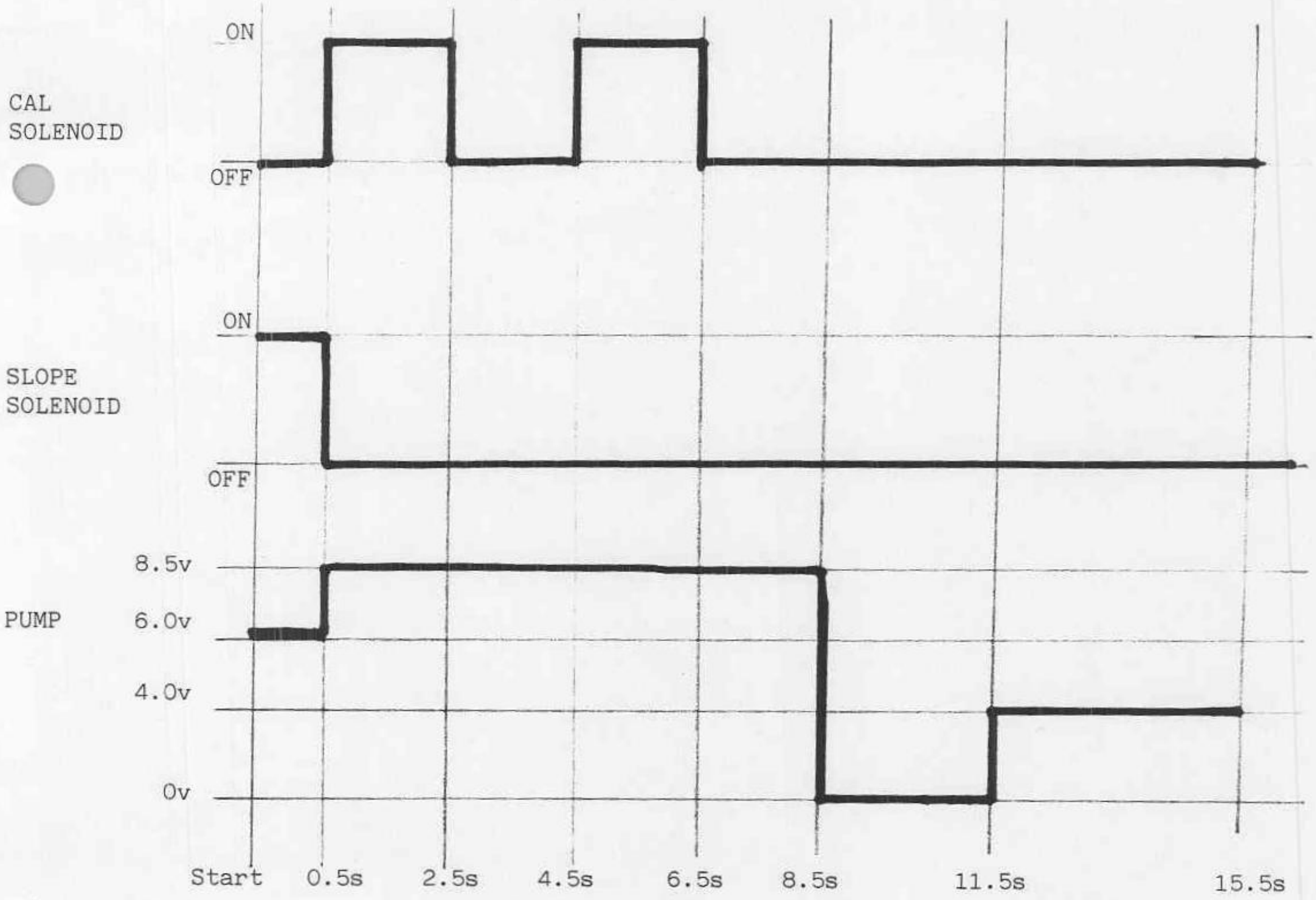


FIGURE 10 SAMPLE CYCLE

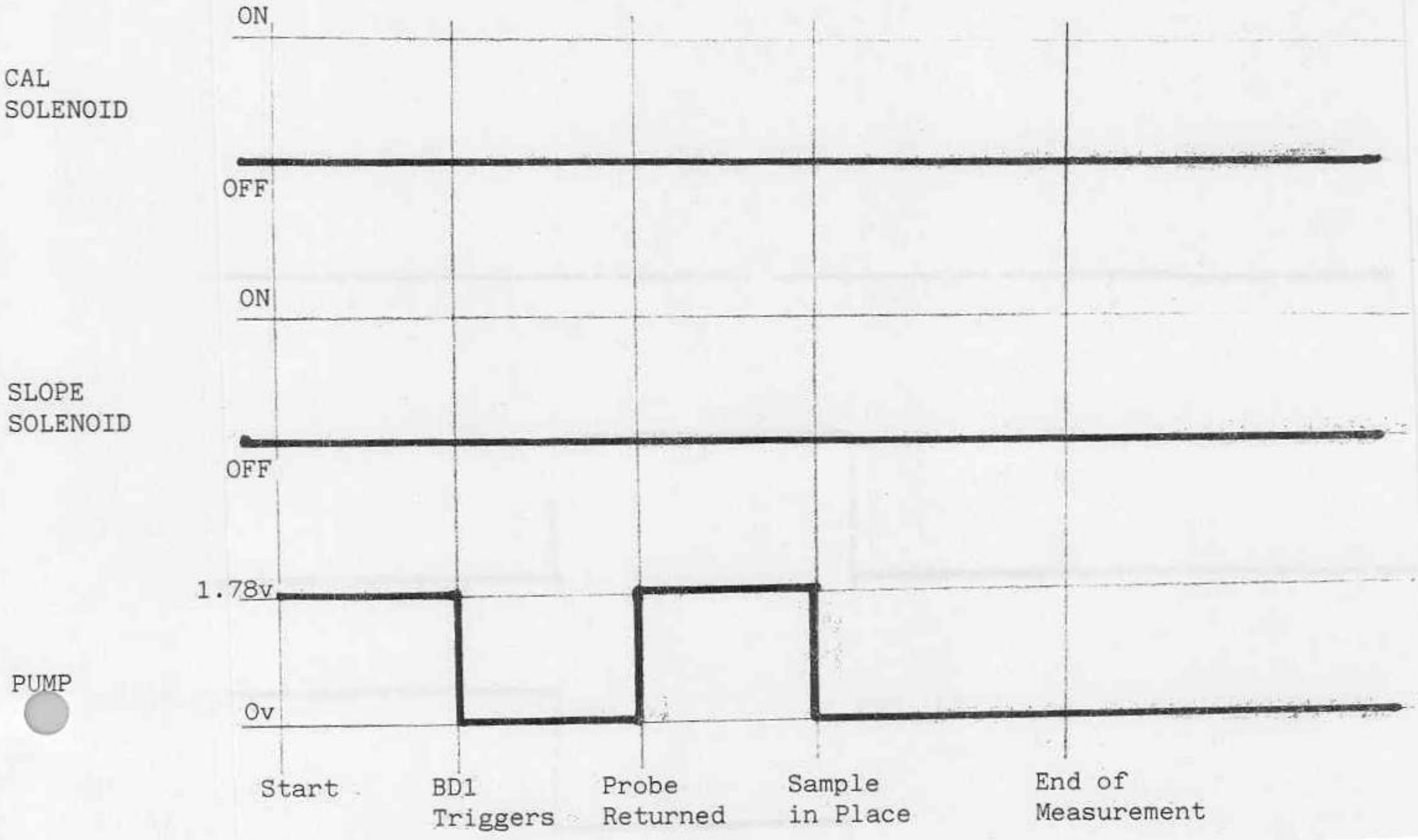


FIGURE 11

CALIBRATION SEQUENCE

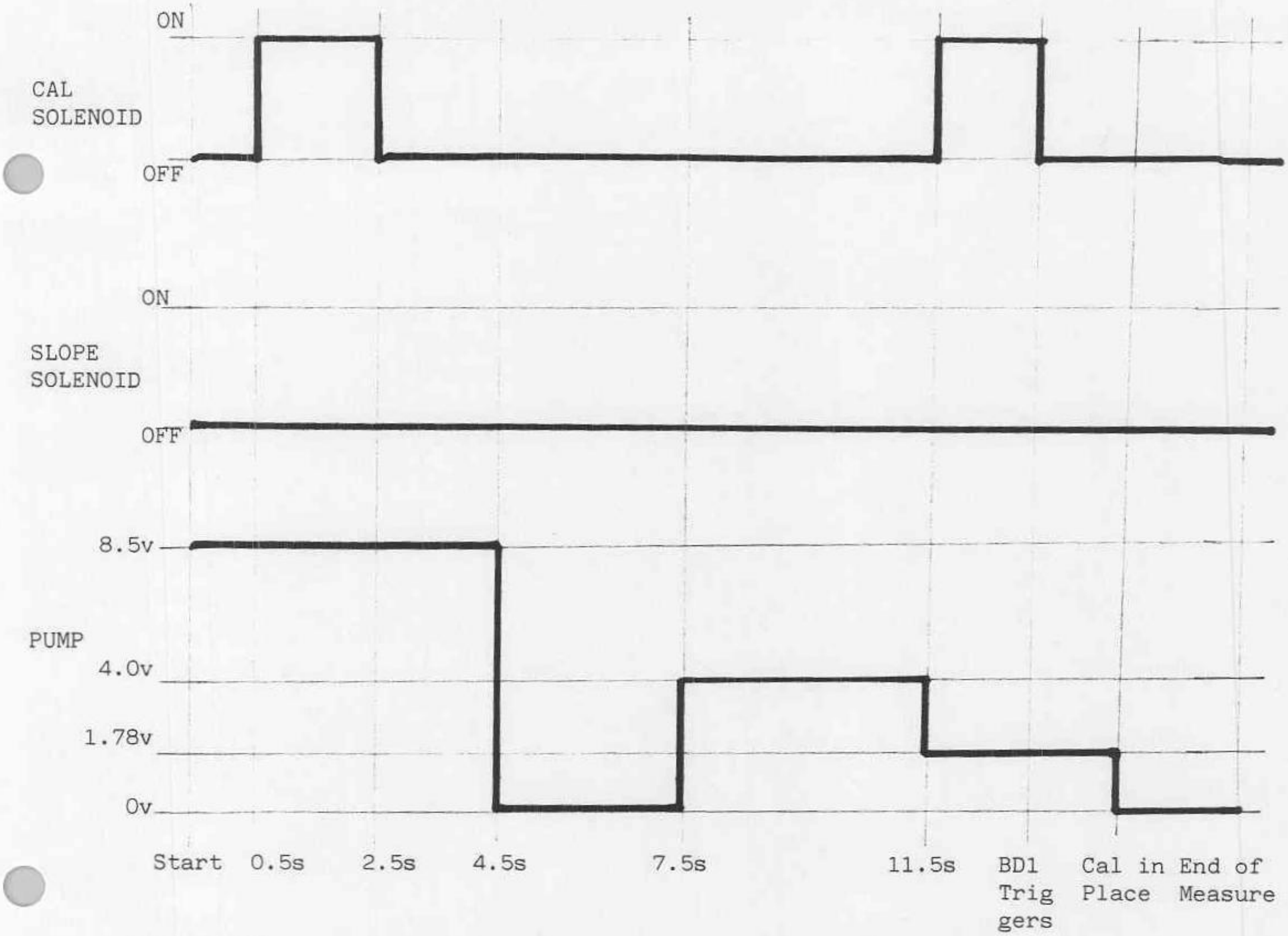


FIGURE 12

SLOPE SEQUENCE

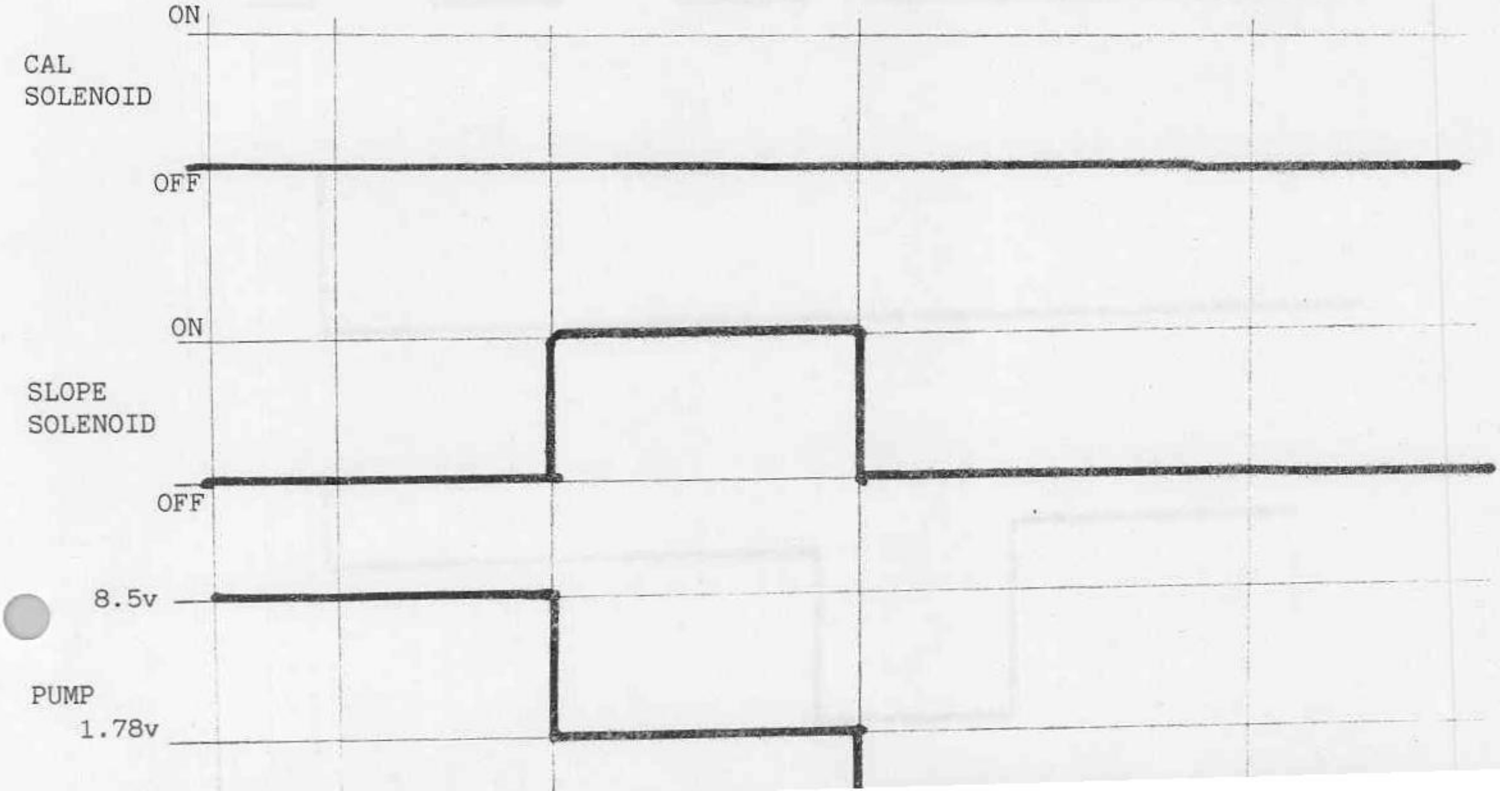


FIGURE 13

PRIME AND DRAIN SEQUENCE

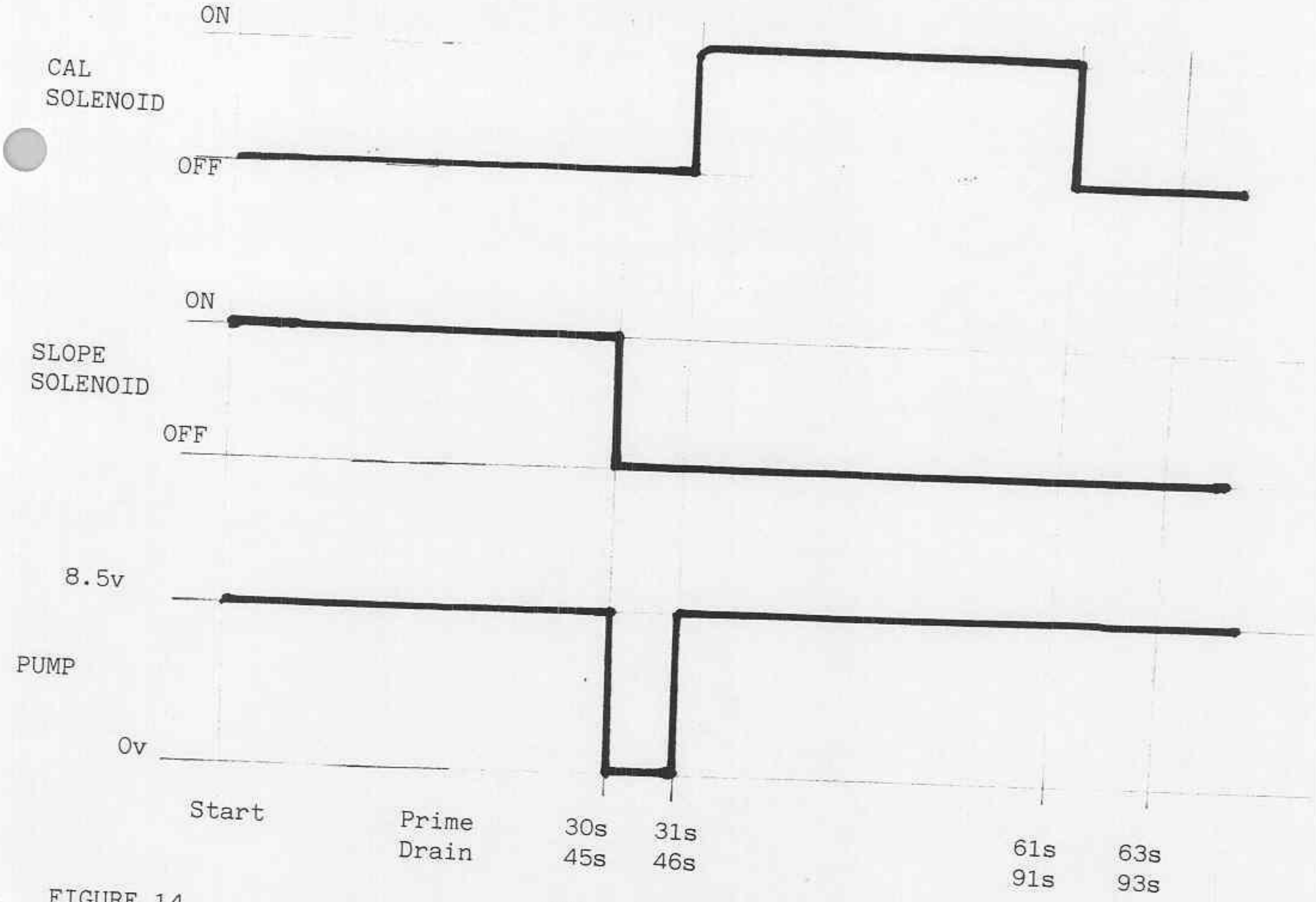
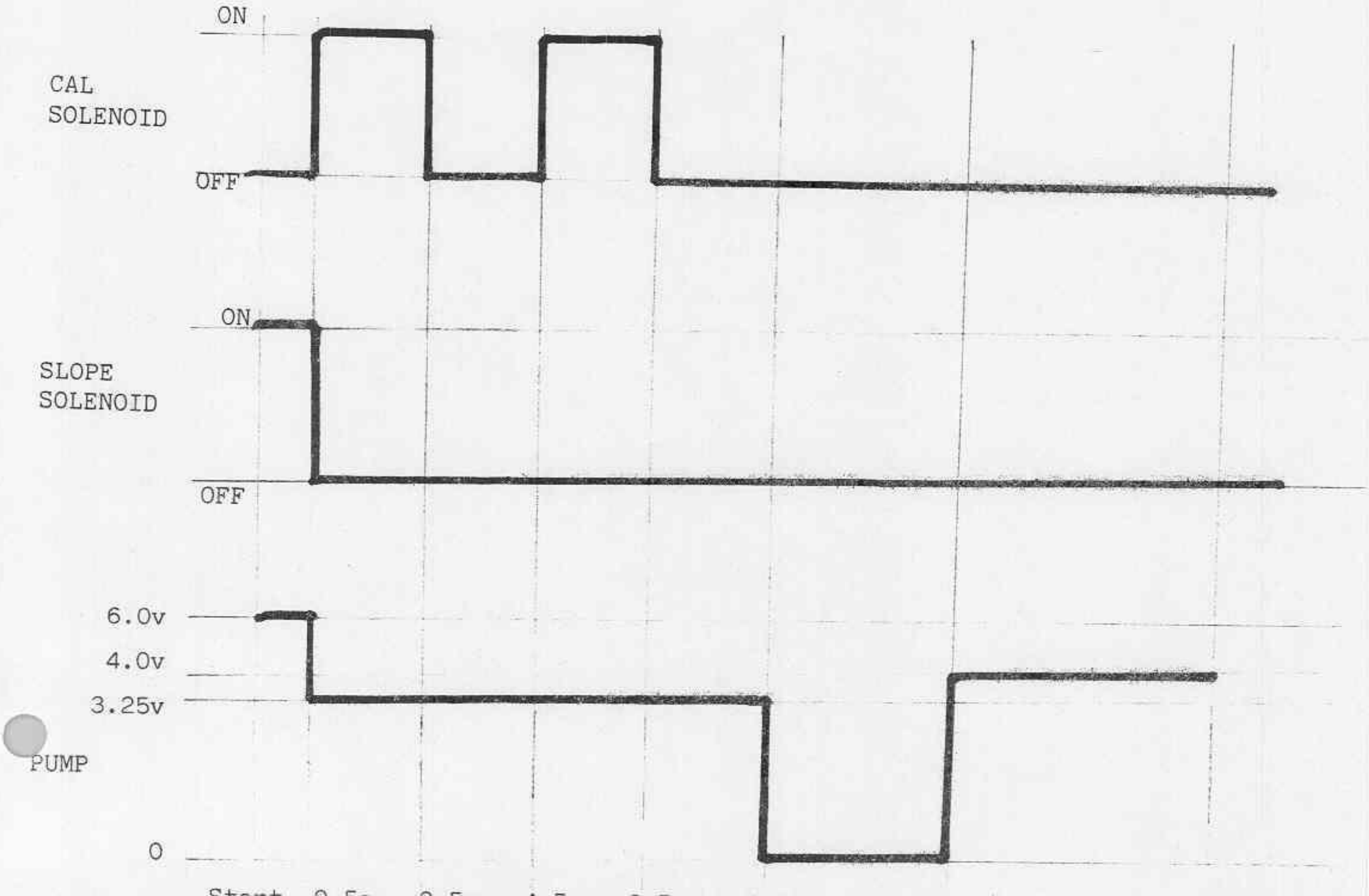

ON
CAL SOLENOID
OFF
ON
SLOPE SOLENOID
OFF
8.5v
PUMP
0v
Start
Prime
Drain
30s
45s
31s
46s
61s
91s
63s
93s

FIGURE 14

WET SEQUENCE


ON
CAL SOLENOID
OFF
ON
SLOPE SOLENOID
OFF
6.0v
4.0v
3.25v
PUMP
0
Start